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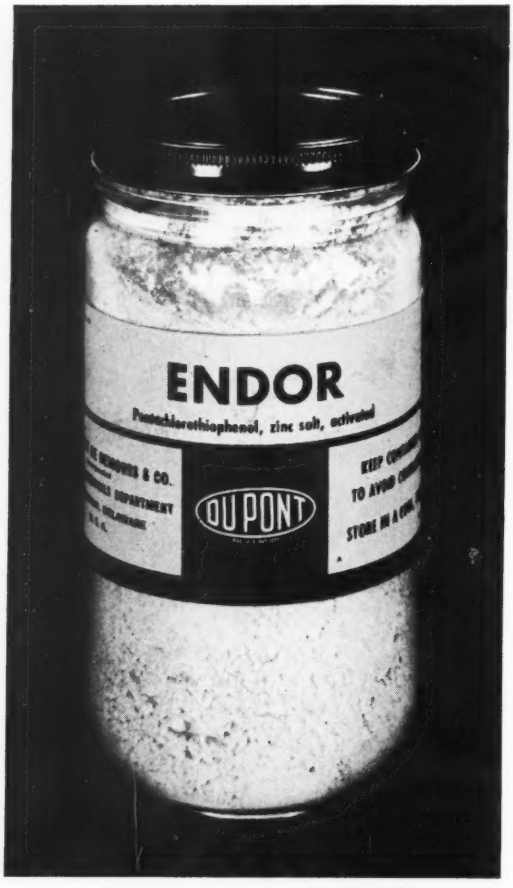
Annual RW Editorial Advisory Board Meeting Held to Review Plans for '59 and Beyond, with Editorial Staff

See page 902

From Du Pont

ENDOR

...a low-cost peptizer



ENDOR is an outstanding peptizer for natural rubber and an effective peptizer for the various SBR types.

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For information on either of these Hycar polymers, or other Hycar rubbers and latices, write Dept. CB-1, B.F.Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

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RUBBER WORLD

ARTICLE HIGHLIGHTS

POLYMER SCIENTIST LOOKS AT RUBBER RESEARCH

The basic principles of polymer science have been applied to the industrial requirements for synthetic rubbers and the relation of certain physical laws to research being done or suggested is examined. **857**

MULTIPLE-PURPOSE RUBBER STABILIZER

A mixed diaryl-p-phenylenediamine called Wing-Stay 100, with excellent solubility in rubber, low volatility, and oxidation rate, is effective as an antioxidant, anti-ozonant, anti-flex cracking agent, and metal deactivator. **863**

FUNDAMENTAL CONTROL TECHNIQUES SERIES BEGINS

This is the first paper in a series on quality control techniques and their use in industry. It provides details on the structure and analysis of frequency distribution data and explains the standard normal frequency distribution curve and its use. **869**

MORE COMPLETE SBR LISTING DEVELOPING

SBRs, whether identified by the standard or experimental ASTM number, if commercial, should be listed as to price and composition in RUBBER WORLD. Faster progress with this project depends on SBR producer cooperation. **855**

PROGRESS IN TESTING BY ASTM COMMITTEE D-11

In special contributed papers and in meetings of its subcommittees the latest progress in testing methods was reported to ASTM Committee D-11 in February. The Mooney cure test has now reached a significant state of development for industry use. **877**

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VOLUME 139, NUMBER 6 MARCH, 1959

CONTENTS

ANOTHER APPEAL TO SBR PRODUCERS ON COMMERCIAL-EXPERIMENTAL RUBBERS
.....An editorial by R. G. Seaman 855

TRENDS IN RUBBER RESEARCH
.....A. V. Tobolsky 857

WING-STAY 100 AS AN ANTIOXIDANT AND ANTIOZONANT—I
.....R. B. Spacht, W. S. Hollingshead, J. G. Lichty 863

FUNDAMENTAL CONTROL CONCEPTS— I—FREQUENCY DISTRIBUTIONS
.....Mason E. Wescott 869

ASTM COMMITTEE D-11 AND SUBCOMMITTEE MEETINGS 877

CHICAGO GROUP PANEL ON SBR TRENDS 886

AKRON GROUP SYMPOSIUM ON NEW ELASTOMERS 889

The opinions expressed by our contributors do not necessarily reflect those of our editors

FEATURE DEPARTMENTS

New Equipment 826
New Products 832
New Materials 840
Book Reviews 842
New Publications 842
News of the Rubber World 851
Meetings and Reports 877
Washington Report 897
Industry News 900
News Briefs 907
News About People 909
Obituaries 916
News from Abroad 917
Market Reviews 920
Synthetic Rubber Prices 924
Compounding Ingredients Prices 925
Calendar of Coming Events 934
Advertisers Index 935

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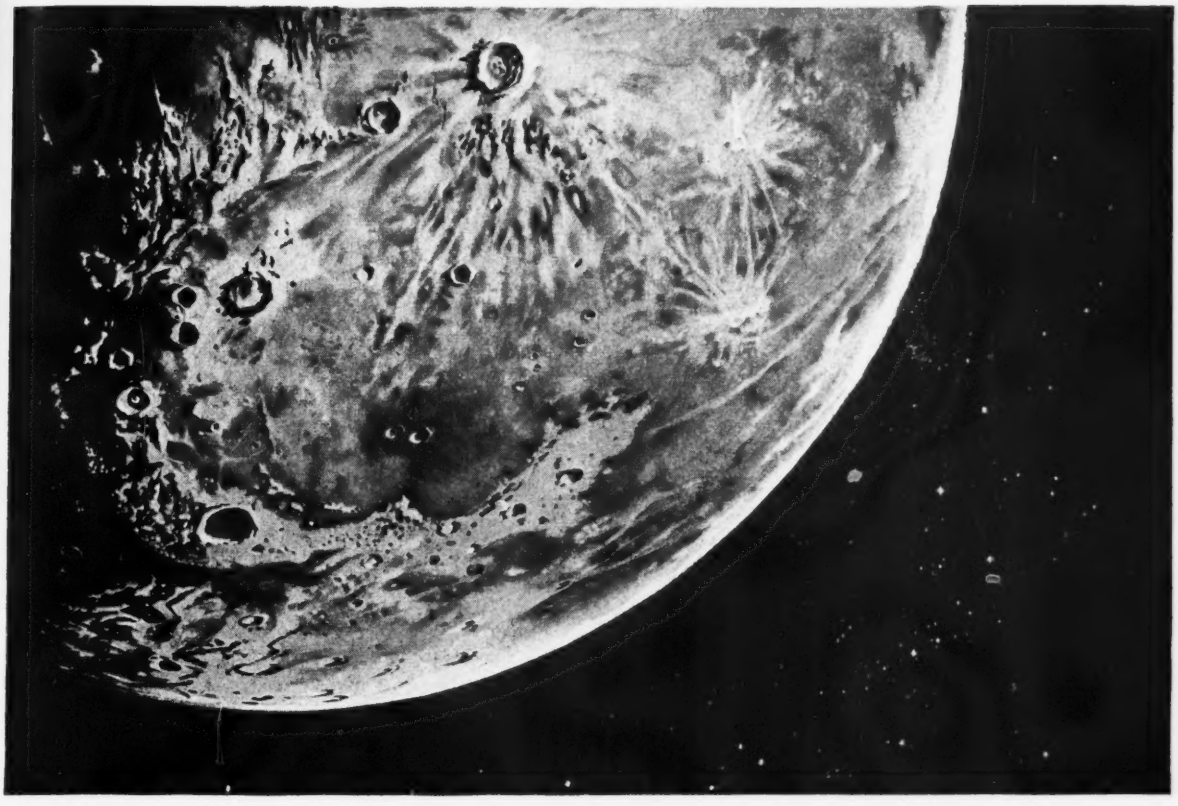

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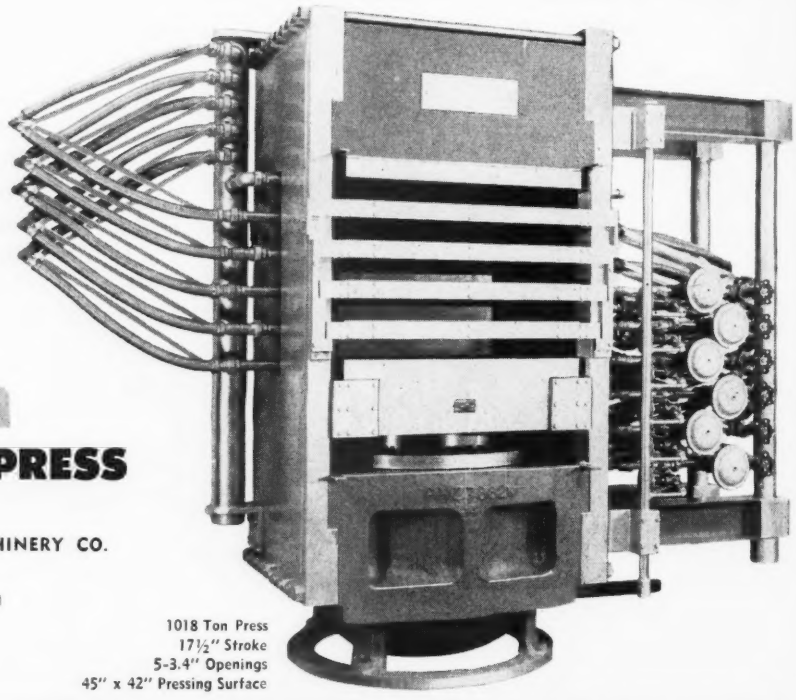

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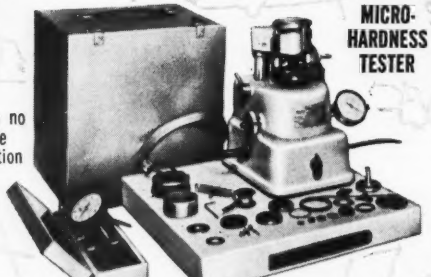

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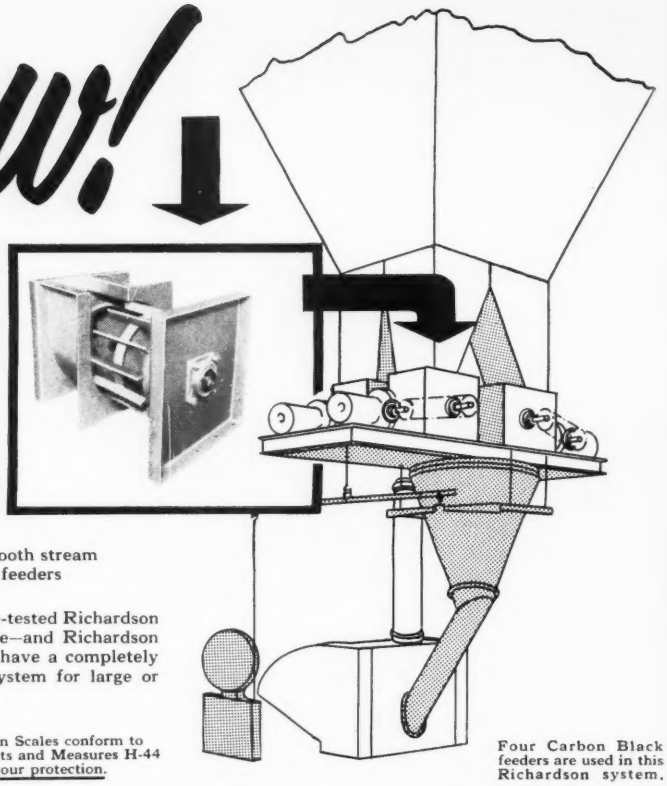

Four Carbon Black feeders are used in this Richardson system.

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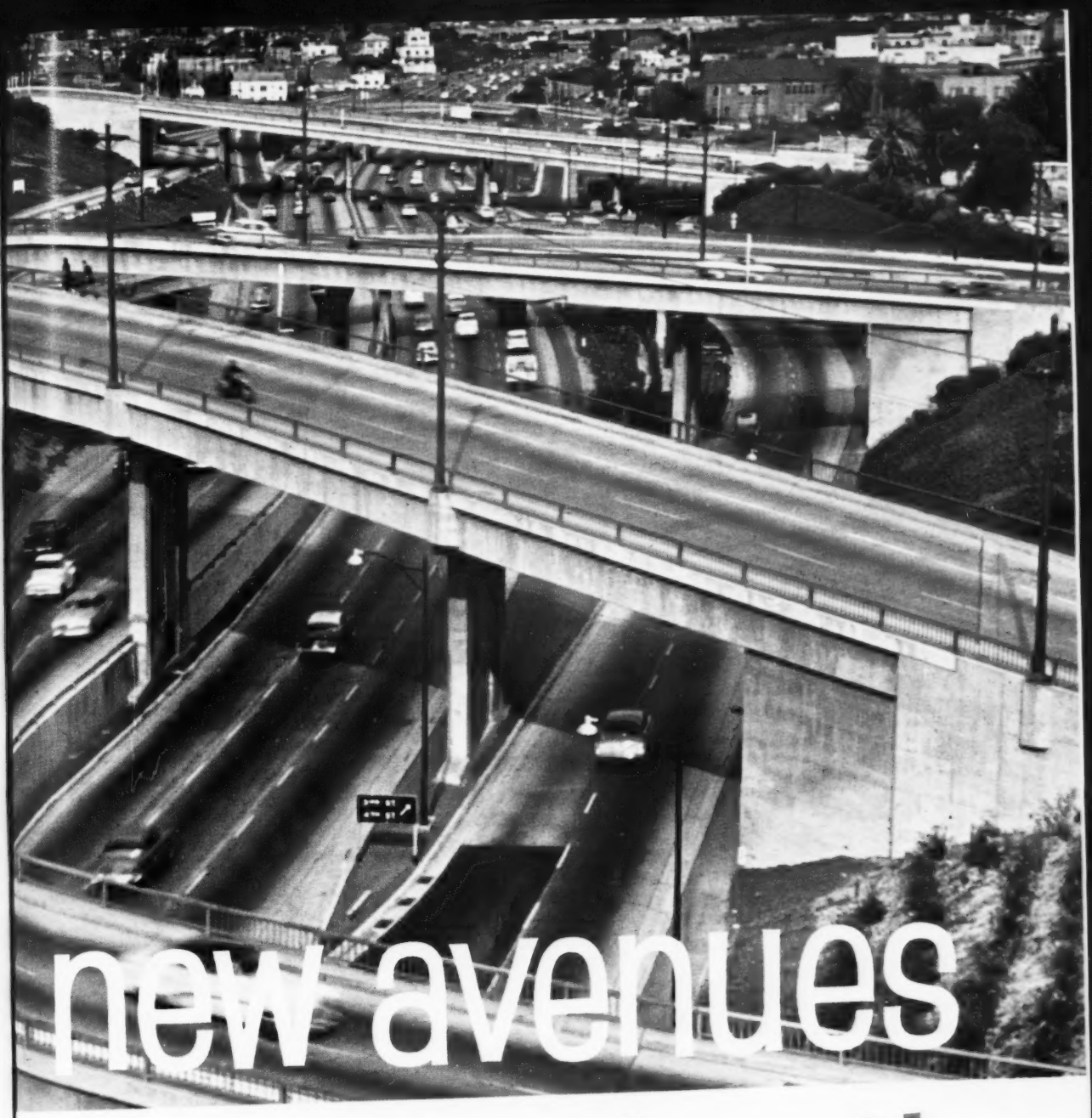


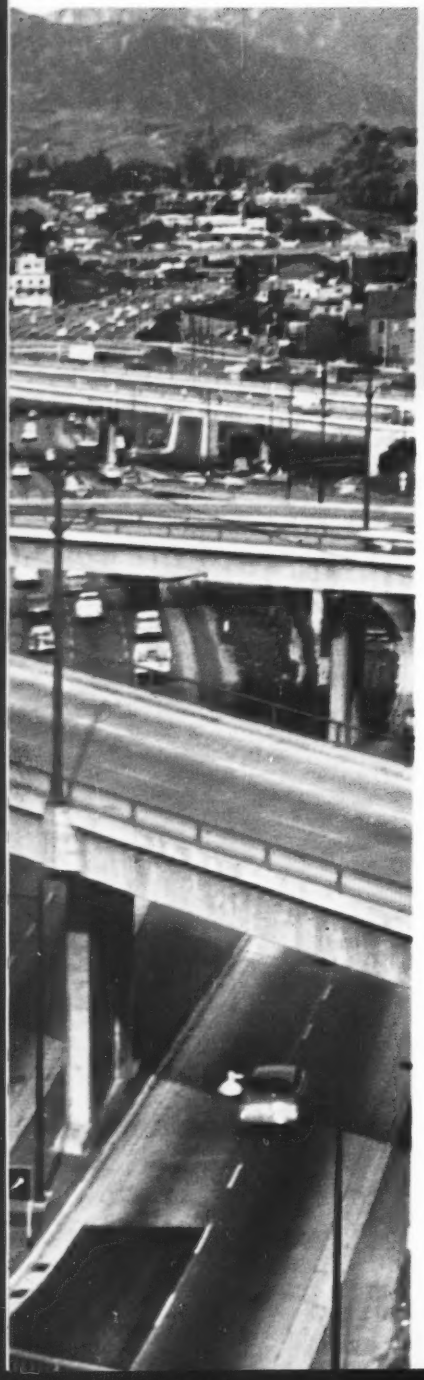
new avenues of opportunity

for rubber compounders are opening now—thanks to a new triple-action chemical from GOODYEAR

Turn the page for all the facts—

Now- GOODYEAR Chemica Div

first truly effective combination of stabili ntic
mixed diaryl-p-phenylenediam pen
for rubber compounders ihes



AUTOMOTIVE PRODUCTS

MOLDED GOODS

Here's why new Wing-Stay 100 can mean better products at lower cost—

As a stabilizer for SBR rubbers—

WING-STAY 100 offers these advantages in discoloring-type polymers:

1 Incorporates in much the same manner as phenyl-beta-naphthylamine.

2 Provides resistance to oxidative degradation and flex-cracking which is much above the accepted minimum level.

3 Is vastly superior to standard stabilizers in antiozonant activity.

4 Serves as a better stabilization building block at no extra cost.

As an additive for SBR rubbers—

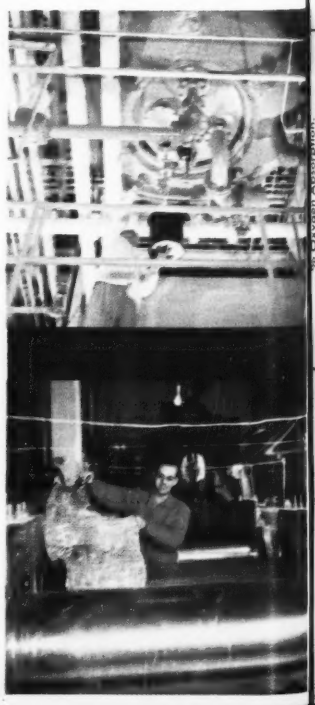
WING-STAY 100 provides these advantages—as a combination antioxidant and antiozonant—in synthetic rubbers:

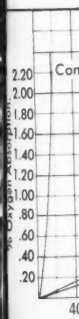
1 Incorporates easily

2 Does not accelerate the cure

3 Does not bloom at normal levels

4 Provides much better over-all protection at lower cost





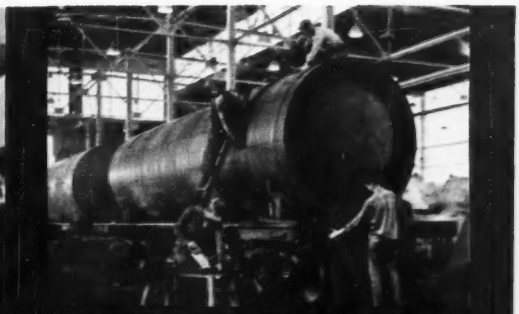
Effect
of a

...a division offers *Wing-Stay 100*

...ent oxidant and antiozonant. This nonvolatile ...inspens... ...these major areas of application—

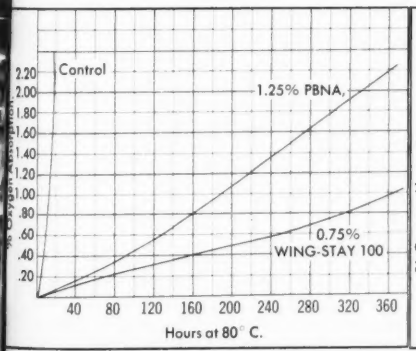
new avenues of opportunity

MECHANICAL GOODS

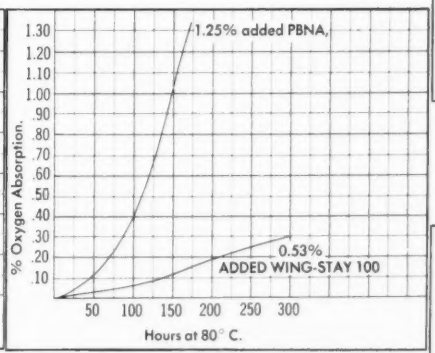


OR A VARIETY OF RUBBER PRODUCTS

Here's proof of new *Wing-Stay 100* **superiority—**

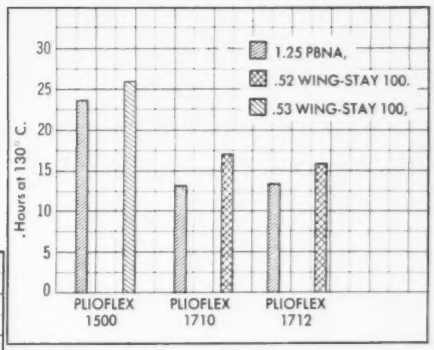


Effect of WING-STAY 100 on the stability of an Oil-Extended SBR Polymer.



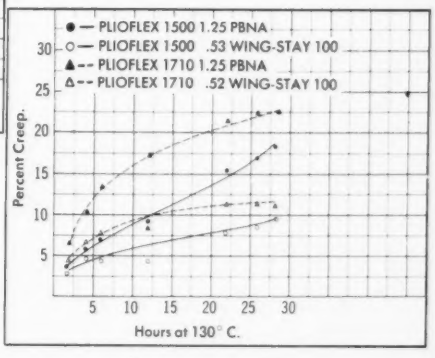
Effect of WING-STAY 100 as added stabilizer in a "cold" nonextended SBR Polymer.

Creep Test on PLIOFLEX Polymers.*



Vulcanized 50 Part HAF Black Compound—Hours to 10% Creep.

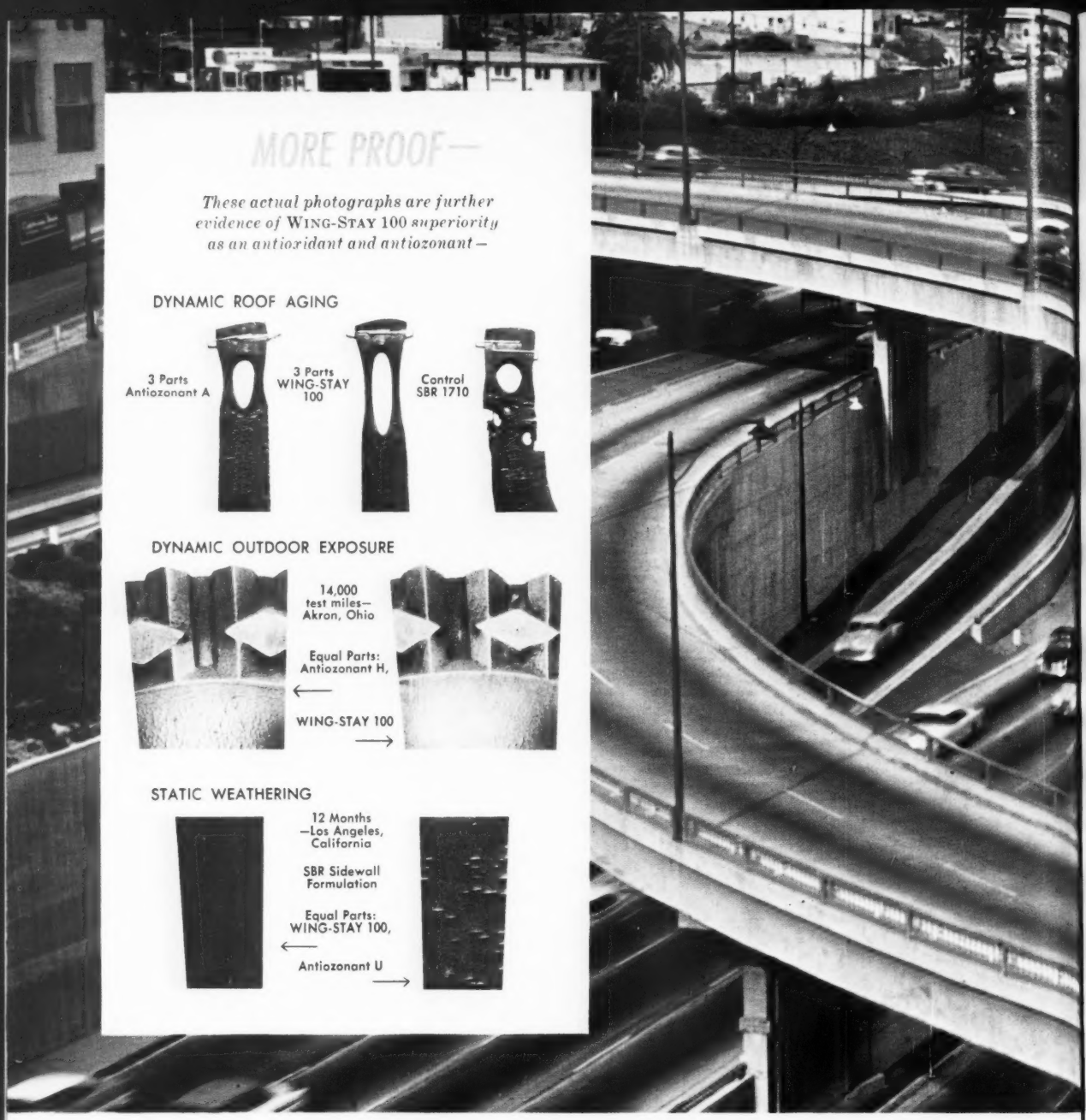
*A measurement of oxidative degradation of rubber in air at elevated temperatures.


PLIOFLEX 1500 1.25 PBNA
PLIOFLEX 1500 .53 WING-STAY 100
PLIOFLEX 1710 1.25 PBNA
PLIOFLEX 1710 .52 WING-STAY 100
Percent Creep.
Hours at 130° C.

Creep Test on PLIOFLEX Polymers.

(Black Compounds containing Copper to magnify Oxidative Degradation)

And that's not all!



MORE PROOF—

These actual photographs are further evidence of WING-STAY 100 *superiority as an antioxidant and antiozonant—*

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3 Parts Antiozonant A

3 Parts WING-STAY 100

Control SBR 1710

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Equal Parts: Antiozonant H, ← WING-STAY 100 →

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Equal Parts: WING-STAY 100, ← Antiozonant U →

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a "cold" nonextended SBR

Plioflex 1710C
a "cold" SBR with 37½ parts of aromatic oil

Plioflex 1712C
a "cold" SBR extended with 37½ parts of highly aromatic oil

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CHEMICAL DIVISION

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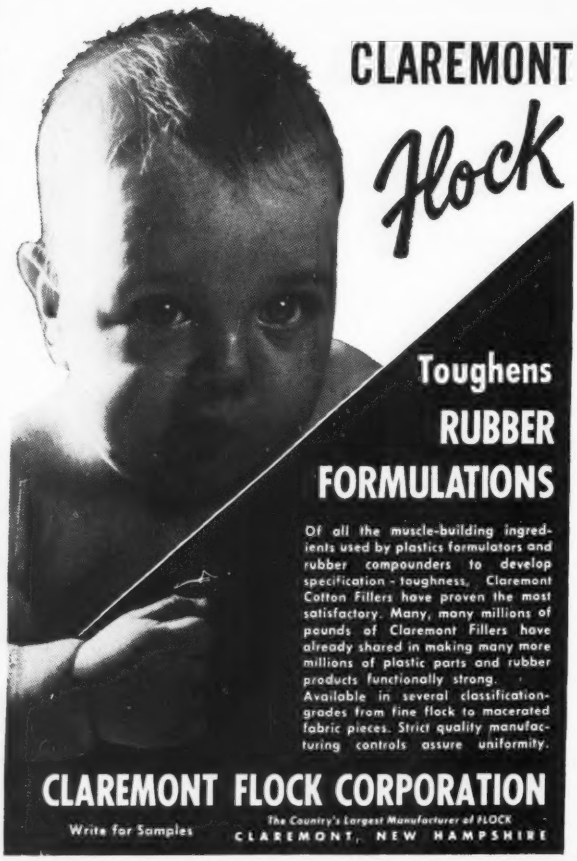

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Sublimed White Lead	Sublimed Blue Lead

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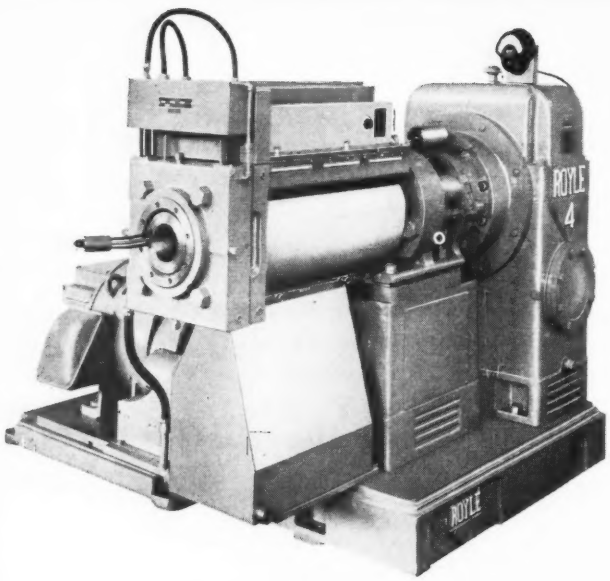

ROYLE SPIROD®

For Maximum Versatility

Whether you are extruding plastics that require high processing temperatures or quick-curing compounds Royle Spirod —the all purpose, all-electric, completely automatic extruder —provides positive temperature control. This versatility is the result of combining a proportioning controlled system of high velocity evaporative cooling with tubular resistance heating to supply constant, accurately zoned processing temperatures.

Send for Bulletin Number 463

JOHN ROYLE & SONS

ROYLE PATERSON N. J. 1880

PIONEERED THE CONTINUOUS EXTRUSION PROCESS IN

London, England	Home Office	Akron, Ohio	Downey, Cal.	Tokyo, Japan
James Day (Machinery) Ltd.	V. M. Hovey J. W. VanRiper	J. C. Clinefelter Co.	H. M. Royal, Inc.	Okura Trading Co., Ltd.
Hyde Park 2430 - 0456	SHerwood 2-8262	BLackstone 3-9222	TOpaz 1-0371	(56) 2130 - 2149

White sidewalls stay white, not only because Johnny, despite Fido, cleans them, but because of modern compounding. Judicious selection of polymer, accelerator and antioxidant enables modern compounding and processing to build *lasting whiteness* into whitewalls

Why white sidewalls stay white

through pigmentation with TITANOX-A *anatase titanium dioxide.* This is the titanium dioxide of proven uniformity of whitening power for whitest whites of constant whiteness and durability in whitewalls.

Although critical whiteness calls for TITANOX-A anatase titanium dioxide, this does not exclude the stronger rutile TITANOX* pigments. For minimum loading of white and tinted stocks and maximum opacity in thin stocks, due to some 25% -or-higher tinting strength, TITANOX-RA (rutile titanium dioxide) is widely used. Similarly TITANOX-RA-50, combining exceptional ease of dispersion with high tinting strength, is preferred in many compositions. This pigment, as well as the "non-chalking" TITANOX-RA-NC, contributes to weather resistance. Titanium Pigment Corporation, 111 Broadway, New York 6, N. Y.; offices and warehouses in principal cities.

TITANIUM PIGMENT CORPORATION
SUBSIDIARY OF NATIONAL LEAD COMPANY

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*TITANOX is a registered trademark for the full line of titanium pigments offered by Titanium Pigment Corporation.

DPR®

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NATURAL CRUDE RUBBER IN LIQUID FORM 100% SOLIDS

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Maggie's DCIsion:

It's time to get your Magnesia problems into orbit—super high safety, but costs down to earth—right on the launching pad. Rocket us a sample request—test, and you'll know, by Jupiter!

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THE ANSWER

to Every OZONE Testing Problem

AUTOMATICALLY CONTROLLED OZONE TEST CHAMBER

OZONE TESTING OF MATERIALS SERVICE

OZONE TEST CHAMBERS

OREC 0300 series ozone test chambers are entirely automatically controlled with panel instrumentation directly indicating in pphm/volume the ozone concentration at which the test chamber is operating. OREC 0300 series provide ozone concentrations required by all ASTM Specifications, as well as all known Producer, Consumer, and Military Specifications.

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Accelerated ozone test chamber testing and Outdoor ozone testing in the stable desert climate of Phoenix, Arizona are provided at economical rates. Tests are conducted according to ASTM or customer specifications.

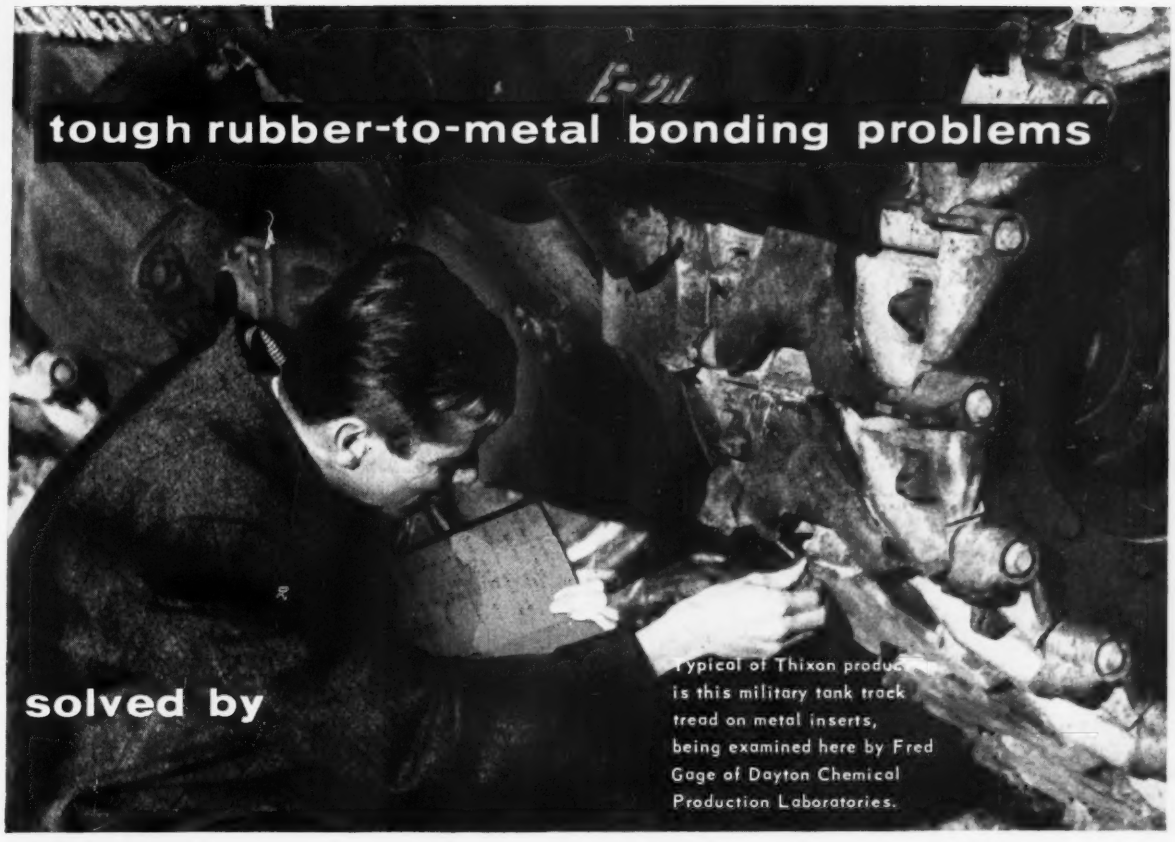
OTHER OZONE EQUIPMENT

Static and dynamic stretching apparatus for ozone testing, Laboratory Ozone Generators, Ozone Measurement Instrumentation, and Custom Ozone Apparatus.

For illustrated brochure, write to:

Ozone Research and Equipment Corporation

3840 North 40th Avenue **Phoenix, Arizona**


tough rubber-to-metal bonding problems
solved by
Typical of Thixon product is this military tank track tread on metal inserts, being examined here by Fred Gage of Dayton Chemical Production Laboratories.

THIXON BONDING AGENTS

Every combination of rubber stock and metal surface offers new problems. Many of them require individual solution with custom adhesive formulas; others can be solved with existing Thixon Bonding Agents. In either case, you can be sure Thixon can meet your specialized bonding requirements, rapidly and accurately.

Your Harwick representative is an important member of this team, briefed on the latest developments and applications in his frequent visits to the Thixon laboratories near Dayton. He is qualified to recommend the proper Thixon Bonding Agent for your needs, or to help you take full advantage of the research and testing facilities of the Thixon laboratories when new problems arise.

Thixon Bonding Agents are supplied in any required quantity, for almost all rubber-to-metal bonds, for splice applications, and bonding of rubber to other materials.

TYPICAL RUBBER-TO-METAL APPLICATIONS

mountings . bumpers . linings . oil seals . pedal covers . rolls . miscellaneous vibration absorption devices . industrial wheels . military tank shoes . valve stems . wire and cable covers . adhesion of insulation . encapsulation jobs

THIXON BONDING AGENTS ARE MADE BY THE DAYTON CHEMICAL PRODUCTS LABORATORIES

FOR TECHNICAL DATA WRITE TO:

HARWICK STANDARD CHEMICAL CO.

60 SOUTH SEIBERLING STREET AKRON 5, OHIO

ALBERTVILLE, ALA. OLD GUNTERSVILLE HWY. • BOSTON 16, MASS. 661 BOYLSTON ST. • CHICAGO 25, ILLINOIS 2724 W. LAWRENCE AVE. • GREENVILLE, S.C. P.O. BOX 746 • TRENTON 9, N.J. 2595 E. STATE ST.

POLYISOBUTYLENE DISPERSION 108

a stable, aqueous dispersion of VISTANEX*. The product is unloaded and yields a colorless, tacky film when the moisture is removed. VISTANEX is widely known for its stability, resistance to aging and chemical inertness. The VISTANEX dispersion is compatible with natural and synthetic latex.

*Trade Mark, Enjay Company, Inc.

SUGGESTED USES

1. Pressure sensitive adhesives
2. Tackifier and binder
3. Protective coatings
4. Sealing compounds
5. Additive for latex compounding
6. Modifier for dextrine, gums and starches
7. Textile coatings
8. Textile laminating
9. Adhesives for flock printing
10. Binder for cellulose, textile and leather fibers.

SPECIFICATIONS and PROPERTIES

Appearance
Milky white liquid

Solids
55% ± 1.5%

pH
10-11

Specific Gravity
0.97 approximately

Coagulum
0.5 max. retained in 60 mesh

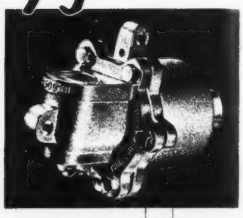
Viscosity
Medium

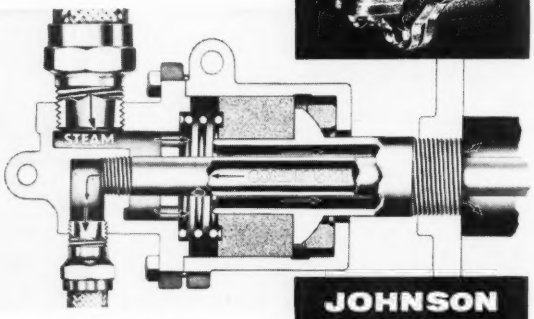
For complete technical data and sample, send to

M-S MILLER-STEPHENSON CHEMICAL CO., INC.
Marshall Street, South Norwalk, Conn.

Need a rotary joint?

... for water-cooled or steam-heated rolls ...



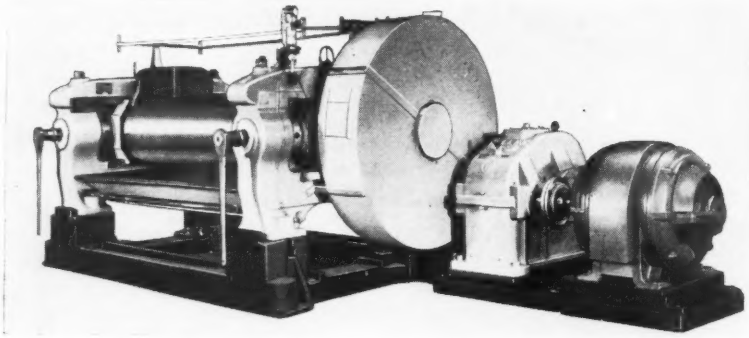


JOHNSON Rotary Pressure JOINTS

Type SB illustrated is completely self-supporting. For fully engineering data write for Bulletin S-3002.

Johnson started the whole idea . . . is far ahead in know-how, available types and sizes. Johnson Joints are completely packless, need no lubrication or adjustment. Used on dryer rolls, mills, waxers, calenders, slashers, printing presses, etc.—handling steam, water, hot heat transfer oils, Dowtherm, Mansanto Aroclors, etc. Actually serving under pressures as high as 2400 psi. Sizes up to 8".

THE JOHNSON CORPORATION
869 Wood St., Three Rivers, Michigan



Above is Frame No. 8, 22"-26" by 84" heavy production mill with reduction unit and 200 h.p. motor. Also available with 26"-26" rolls and with special lengths up to 100"

In the long run YOU'RE AHEAD with a STEWART BOLLING MILL!

MODERN, Rugged, Dependable

11 Sizes:
from small laboratory mills through the largest production sizes.

For continuous heavy duty mill production, Stewart Bolling sets the pace. Bolling mills embody all the latest safety and operating features, along with important mechanical improvements which meet industry's demands for low cost production. In addition, Stewart Bolling offers the widest range of experimental mills in both standard and Ultra models. The latter represent a new concept in laboratory mills for every conceivable requirement in the manufacture of both rubber and plastics.

For a complete description of Stewart Bolling's line of mills, Write on your letterhead for Catalog 56-W.

B **STEWART BOLLING & COMPANY, INC.**
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Plasticizer Data

TO HELP YOU CHOOSE THE RIGHT PLASTICIZER

these Harflex® Polymeric Plasticizers are permanent

Harflex 300 polymeric plasticizer

non-migratory
fast processing
excellent dry blending
good low temperature properties
can be used as sole plasticizer

physical data

100% Modulus	1320 psi
Tensile Strength	2695 psi
Elongation	338%
Hardness, Shore A	80
T_f	−17.3°C.
Flux Time	45 seconds

heat stability (180°C.)

Initial Discoloration	15 min.
Maximum Discoloration	90 min.

extraction loss

Water	0.21%
1% Soap	3.45%
Mineral Oil	2.10%

migration

Lacquer, 25°C., 14 days	Very slight softening
Varnish, 25°C., 14 days	No effect
Polystyrene, 60°C., 19 days	No effect

Harflex 325 polymeric plasticizer

economical
non-migratory, permanent

Both these Polymerics are used with Vinyl Chloride Polymers and Copolymers, Polyvinyl Acetate, Synthetic Rubbers, Nitrocellulose, Cellulose Acetobutyrate, and Polymethyl Methacrylate.

physical data

100% Modulus	1320 psi
Tensile Strength	2471 psi
Elongation	350%
Hardness, Shore A	76
T_f	−12.5°C.
Flux Time	60 seconds

heat stability (180°C.)

Initial Discoloration	15 min.
Maximum Discoloration	90 min.

extraction loss

1% Soap	2.6%
Mineral Oil	1.2%

migration

Lacquer, 25°C., 14 days	Slight staining, very slight softening
Varnish, 25°C., 14 days	Slight staining
Polystyrene, 60°C., 19 days	No effect

Harchem produces a full line of phthalate, adipate, sebacate and polymeric plasticizers in addition to the plasticizers shown.

The Harchem Division laboratories will gladly assist you with your plasticizer problems, or will supply additional data including formulation test methods and formulation suggestions for any Harflex Plasticizer.

Address inquiries to Dept. H-42R

SEBACATES
PHTHALATES
ADIPATES

THE KEY TO HARCHEM® BETTER PLASTICS

Columbian Carbon Company, Distributor To The Rubber Industry

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cut your cost
our quote will convince you that your extruder pack screens cost can be lowered. We are serving America's largest extruders. **Prices include delivery anywhere in U.S.A.**

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reduce your overhead
and storage costs by ordering extruder pack screens as you need them from our large, diversified stock of wire cloth.

fast delivery
we have available for immediate cutting and shipping screen of any metal . . . Steel, Stainless Steel, Monel, Brass . . . in mesh sizes 2 to 200 . . . to any diameter.

Serving Industry for 126 Consecutive Years
With Top Quality Woven Wire Cloth
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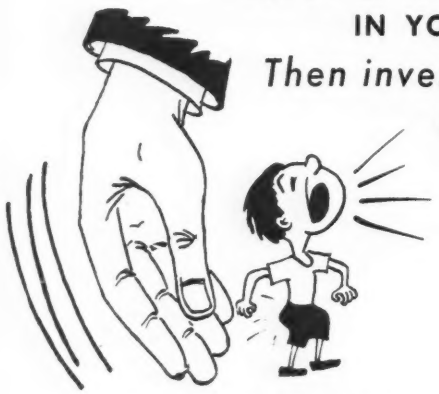
HAVE YOU A "PROBLEM CHILD"
IN YOUR COMPOUNDING DEPARTMENT?
Then investigate these helpful "Factice" facts!

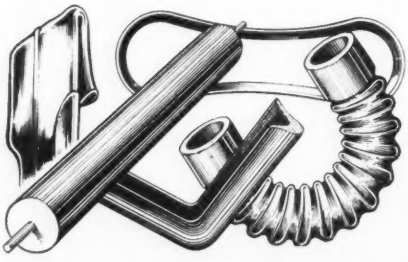


Neophax is

- compatible with Neoprene, synthetics, and crude rubber,
- aids in processing,
- improves extrusion, maintains die size,
- stabilizes mold dimensions,
- permits wide durometer range,
- yields ultimate plasticizing.

FACTICE®
Neophax®

Feel free to submit your problems to us. Just explain your difficulty, or describe the effect you wish to achieve. Without obligation, our laboratory will gladly make helpful recommendations. Data on request any time.



Factice
THE STAMFORD RUBBER SUPPLY CO.
Vulcanized Oil

THE STAMFORD RUBBER SUPPLY CO., STAMFORD, CONN.

LUXURIOUS ACCOMMODATIONS FOR TWO

Perhaps it's just as well that this runabout, designed about 1915, never got into mass production. No one could have believed it . . .

But the vehicle had practical and ingenious features despite its awkward appearance. Actually a converted motorcycle, its chassis was made of steel tubes which could be taken apart and carried in a bundle. A contemporary description said that "the body affords almost luxurious accommodations for two, is provided with a windscreen and excellent folding top."

This design is merely one of many odd and novel approaches men have used in seeking adequate transportation. Out of this experimenting have come today's speedy and efficient automobiles and trucks.

For more than 34 years United Carbon Company has participated in this evolution of our transportation system: for this system depends on the rubber tire, and billions of pounds of UNITED CARBON BLACKS have gone into the making of these tires.

Specify UNITED CARBON BLACKS: they're made to meet today's — and tomorrow's — needs.

UNITED CARBON COMPANY, INC.

To the ancient Greeks "KOSMOS" meant the world in all its complexity, harmony and order.

Today, this - **KOSMOS**

means carbon blacks of excellence.

KOSMOS blacks are made for a world of compounding needs — specify them for superior results.

KOSMOS 70 ISAF — Ideal for toughest treads, maximum mileage tires, for gruelling high speed highway operations, and for high electrical conductivity.

KOSMOS 60 HAF — Recommended for good processing, highest reinforcement, extra mileage tires, tread rubber (camelback), and outstanding resistance to cuts and cracks.

KOSMOS 50 FEF — Superior as processing aid; for imparting good, smooth, fast extrusions; for maintaining dimensional stability; for dissipating heat.

KOSMOS 40 HMF — Recommended for good processing, substantial reinforcement, ready dispersion, high rebound, low heat build-up, high resistance to flex.

KOSMOS 35 GPF — For tire body stocks and general purpose applications where high resiliency, low heat build-up, high strength at elevated temperature and good flex resistance are essential.

KOSMOS 20 SRF — Excellent for highly loaded rubber goods; easy and cool mixing; semi-reinforcing; low in heat generation; high in resilience.

KOSMOBILE 77 EPC — Recommended for good processing, for high level of reinforcement, high tensile strength, good resistance to abrasion.

KOSMOBILE S-66 MPC — For rubber goods requiring high reinforcement, high tensile strength, highest resistance to tear and good resistance to abrasion.

KOSMOS BB (Voltex) CC — Ideal in polyethylene for resistance to ultraviolet radiation; for coloring of plastics and for high electrical conductivity.

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A subsidiary of United Carbon Company

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IN CANADA: CANADIAN INDUSTRIES LIMITED

MONSANTO RUBBER CHEMICALS ANSWER ANOTHER IMPORTANT COMPOUNDING QUESTION:

What delayed-action sulfenamide accelerators are my easiest-to-use, surest protection against scorch?

ANSWER:

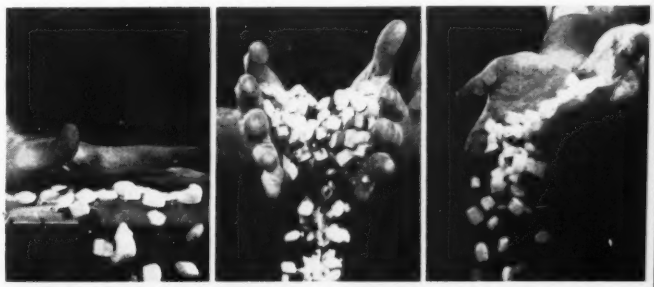
New Santocure and Santocure NS "BRIQUETTES"

ACTUAL SIZE

Look how new BRIQUETTES of Santocure and Santocure NS give you more plant-handling ease and convenience. Free-flowing BRIQUETTES won't pack, "bridge" and surge like dry powders —are ideal for automatic weighing or scoop handling. No weighing losses. No rolling! No sticking to the throat or ram of the banbury. Now, with maximum ease of weighing and handling, you can be sure of the delayed-action, safer cures that the Santocures are known to give.

Still the most popular and lowest cost, Santocure was the first uniformly successful sulfenamide accelerator. Powerful Santocure NS gives even greater safety from scorch—up to 10% less accelerator may be used for similar fast, flat curing rates.

Whenever scorch problems threaten . . . from more rapid processing, higher temperatures, thicker sections, greater activation from reinforcing furnace blacks . . . try Santocure or Santocure NS BRIQUETTES. Write for sample and technical help in your application.



WON'T CAKE! WON'T BRIDGE! ALWAYS FLOW FREELY BUT WON'T ROLL

Santocure: Monsanto T. M. Reg. U.S. Pat. Off.

LET MONSANTO RUBBER CHEMICALS ANSWER YOUR NEXT COMPOUNDING QUESTION

Jot it down on the nearest sheet of paper and send it in with your return address. No obligation—no salesman will call (unless you so request). To help you solve specific problems, Monsanto draws from *basic* knowledge of more than 85 rubber chemicals and over 18,000 compounding studies. Write, today.

FOR SAMPLE, USE HANDY COUPON

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Rubber Chemicals Department
Akron 11, Ohio

Please send me a sample of new

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Name .....

Company .....

Address .....

City ..... Zone ..... State .....

NOW AVAILABLE...

7 TYPES OF AMERIPOL MICRO-BLACK MASTERBATCH

TYPE 4650

A high dispersion carbon black masterbatch consisting of HAF black in a rosin acid emulsified cold polymer. Composition: Type 1500 Ameripol, 100 parts; HAF black, 55 parts; heavy processing oil, 10 parts. For tires, premium quality tread rubber, mechanical goods, extruded goods.

TYPE 4651

A high dispersion carbon black masterbatch consisting of HAF black in a rosin acid emulsified cold polymer. Composition: Type 1500 Ameripol, 100 parts; HAF black, 62.5 parts; heavy processing oil, 12 parts. For tires, premium quality tread rubber, mechanical goods, extruded goods.

TYPE 4652

A high dispersion carbon black masterbatch with a high loading of medium thermal black in a rosin acid emulsified cold SBR copolymer. Composition: Type 1501 copolymer, 100 parts; medium thermal carbon black, 150 parts. For mechanical goods, floor matting.

TYPE 4654

A high dispersion carbon black masterbatch of ISAF black in a rosin acid emulsified cold SBR copolymer. Composition: Type 1500 copolymer, 100 parts; ISAF black, 52 parts; heavy processing oil, 10 parts. For tires, premium quality tread rubber.

TYPE 4655

A high dispersion carbon black masterbatch of HAF black in a rosin acid emulsified SBR copolymer. Composition: Type 1500 copolymer, 100 parts; HAF black, 52 parts; heavy processing oil, 10 parts. For tires, premium quality tread rubber, mechanical goods, extruded goods.

TYPE 4750

A high dispersion carbon black masterbatch of HAF black in a highly aromatic oil extended, mixed acid, SBR copolymer. Composition: Type 1712 oil extended copolymer, 137.5 parts; HAF black, 75 parts. For tires, medium quality tread rubber.

TYPE 4751

A high dispersion carbon black masterbatch of FEF black in a naphthenic oil extended, all fatty acid, SBR copolymer. Composition: Type 4700 oil extended copolymer, 150 parts; FEF black, 100 parts. For low cost tread rubber, automotive extrusions, mechanical goods, floor matting.

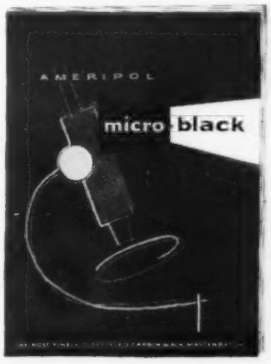
Now you can select the right black masterbatches for your particular products from *seven* high-dispersion types offered by Goodrich-Gulf.

These Ameripol Micro-Black masterbatches will help you improve your process control, mix rubber recipes easier and faster, reduce handling and compounding costs, and gain superior dispersion over conventional dry mixes. Here's why.

High liquid-shear agitation in the Goodrich-Gulf process assures thorough dispersal of carbon black at the latex stage, just before coagulation, in the production of Micro-Black masterbatches. You get better batch uniformity. Greater abrasion resistance in your finished products.

See how you can cut costs with Ameripol Micro-Black. You eliminate a weighing and mixing operation, and a messy clean-up problem, because carbon black is already integral with the compound. Warehousing is simplified because you eliminate one raw material. Handling is easier, too, because Micro-Black is shipped bareback. It does not cold flow.

New data book—For complete information on all seven of these black masterbatches, write for new illustrated Micro-Black data book.



Goodrich-Gulf Chemicals, Inc.

3121 Euclid Avenue, Cleveland 15, Ohio

	Type 4650	Type 4651	Type 4652	Type 4654	Type 4655	Type 4750	Type 4751
Chemical Properties							
Volatile matter, %	0.11	0.12	0.05	0.12	0.12	0.15	0.09
Ash, %	0.28	0.32	0.13	0.20	0.14	0.31	0.19
Rosin acid, %	3.83	3.74		3.84	3.81		
Rosin soap, %	0.01	0.01	0.00	0.01	0.00	0.04	
Organic acid, %			2.48				
Mixed acid, %						2.77	
Fatty acid							2.16
Physical Properties (Cure 50′ @ 292° F.)							
Tensile, psi.	3315	3389	1660	3950	3370	3340	2265
Elongation, %	547	474	470	650	655	660	440
Modulus, 300%, psi.	1742	2243	1200	1400	1295	1380	1650
Hardness, Shore A	64	68	64	65	60		66
Compound viscosity, ML4 @ 212° F.	60	69	82	54	52	72	79
Test Recipe							
Ameripol	150.0	156.0	250.0	147.5	147.5	154.5	166.5
Zinc oxide	5.0	5.0	5.0	5.0	5.0	1.5	5.0
Sulfur	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Stearic acid	1.5	1.5	1.5	1.5	1.5	—	—
Benzothiazyldisulfide	2.0	2.0	2.0	2.0	2.0	1.0	1.5
	160.5	166.5	260.5	158.0	158.0	159.0	175.0

NOTE: Above data based on the test recipes indicated. They are given for information only, as we cannot accept responsibility for operations not under our direct control.

You make them
We road test them

On the most natural Proving Grounds in America—South Texas

This independent test fleet is located in Devine, Texas, some thirty-two miles southwest of San Antonio on U S Hiway 81. Sponsors have a choice of three routes from which to choose. Test procedures are flexible. Tire rotation, cycle miles, number and frequency of reports or routing, can be a basis for discussion if the sponsor so desires. We endeavor to operate to the best advantage of the sponsor. Because we are wholly independent of any organization, all information collected is responsible to the sponsor only.

Tires of all specifications tested—both passenger car and truck. Your inquiries will receive prompt attention.

SOUTH TEXAS TIRE TEST FLEET, Inc.

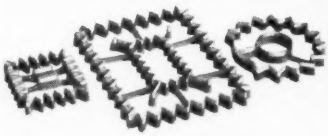
Phone Morris 3-4428 DEVINE, TEXAS P. O. Box 353

A. J. (AL) Morrow, Pres. & Gen. Mgr.

EXPERIENCE... WE HAVE OVER 50 YEARS OF IT...

INDEPENDENT AND NEW ERA

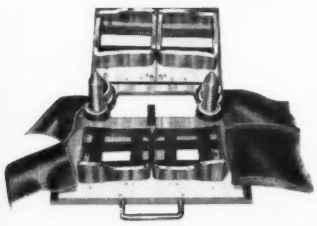
Dies For Every Conceivable Purpose



CLICKER, WALKER PUNCH PRESS and MAUL HANDLE

DISTRIBUTORS FOR:

- Foles Clicker Machines and Seelye Beam Die Presses
- Hard Maple, Rubber, and Fibre Composition Die Blocks
- Rubber Pads
- Die Block Hardener
- Raw Hide Mauls



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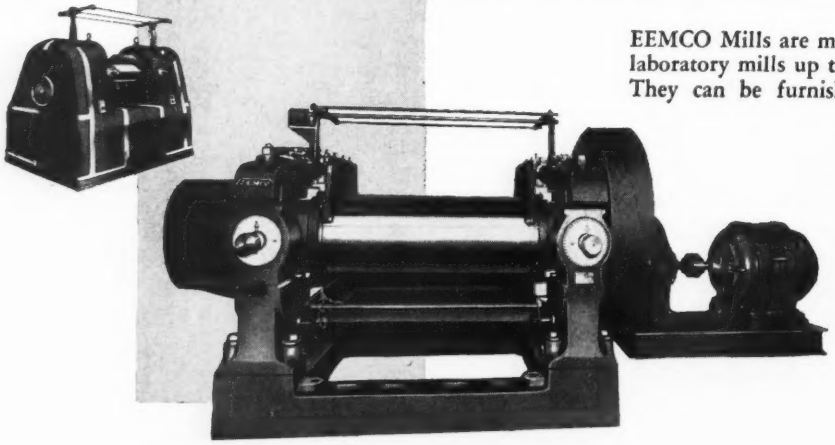
LA SALLE & OHIO STS. . . . ST. LOUIS 4, MISSOURI

Associate: NEW ERA DIE CO. Red Lion, York County, Pa.

available in a complete range of sizes
EEMCO RUBBER and PLASTICS MILLS
are engineered for your job in STANDARD or CUSTOM units



EEMCO Mills are made in standard sizes from laboratory mills up to and including 84" mills. They can be furnished with any extras you desire, including individual drives, right angle or floor level drives, or for "in line operation."

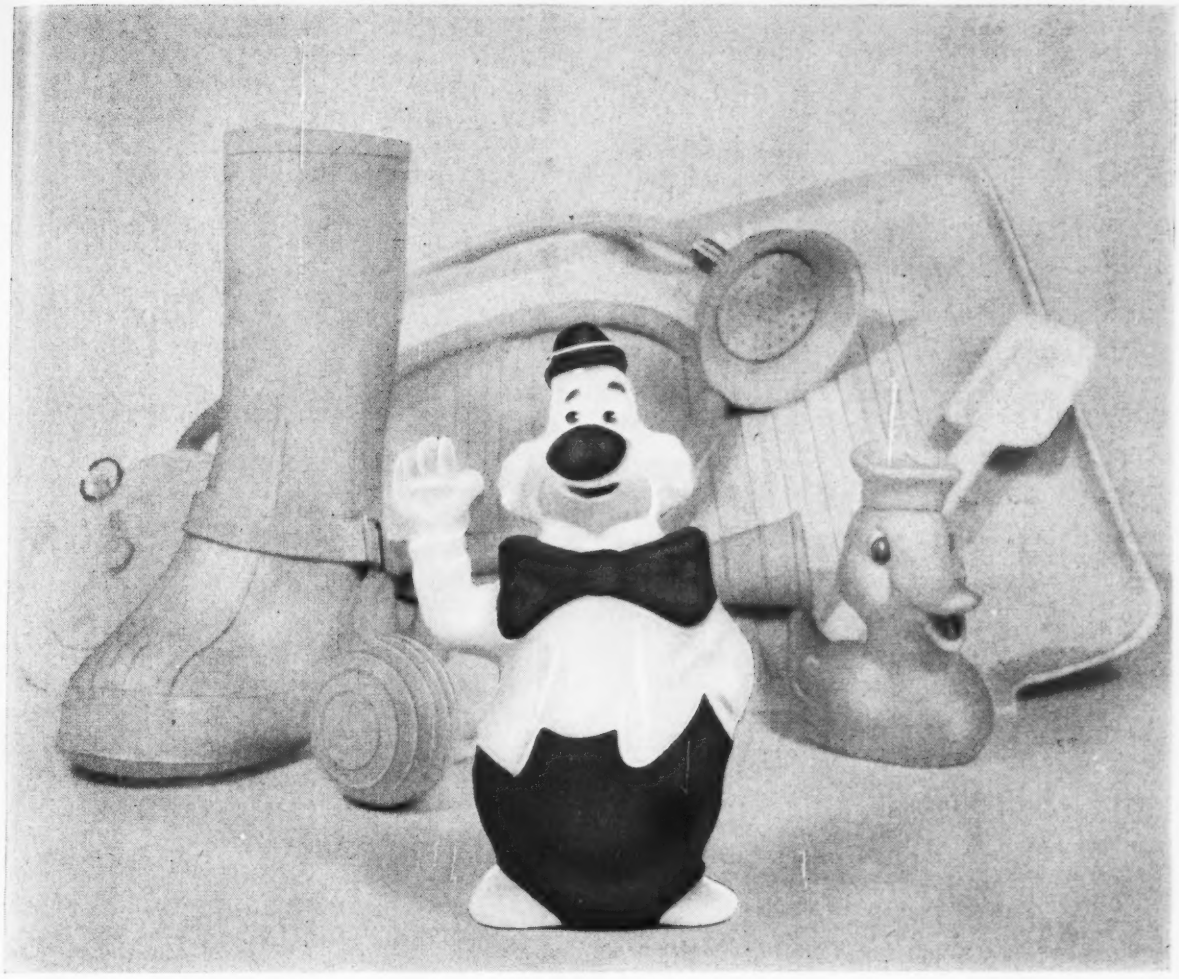
Consult EEMCO before you buy; call or write us today stating your requirements.

EEMCO

ERIE ENGINE & MFG. CO.

951 EAST 12th STREET, ERIE, PA.

MILLS • PRESSES • LOADERS • LIFT TABLES • PLATENS • PREFORM MACHINES • ROVING CUTTERS



If you need a good non-staining, non-discoloring antioxidant . . . write for technical service reports on Neville Nevastains*

Neville manufactures two excellent non-staining, non-discoloring antioxidants under its tradename "Nevastain". Nevastain A is in liquid form with very low volatility and good stability. Nevastain B was developed for those who prefer the product in flaked form. It is shipped in sturdy 50-pound bags for easy weighing and handling.

In many instances, both Nevastains have proved themselves in formulation to be equal or superior to products of considerably higher cost.

We suggest that you may benefit by using the coupon below to write for our technical reports.

Neville Chemical Company, Pittsburgh 25, Pa.

Resins—Coumarone-Indene, Heat Reactive, Phenol Modified Coumarone-Indene, Petroleum, Alkylated Phenol • **Oils**—Shingle Stain, Neutral, Plasticizing, Rubber Reclaiming • **Solvents**—2-50 W Hi-Flash*, Wire Enamel Thinners, Nevsolv*.

*Trade Name

NEVILLE

Please send Technical Service Report on Nevastain A. ☐
Please send Technical Service Report on Nevastain B. ☐

NAME TITLE

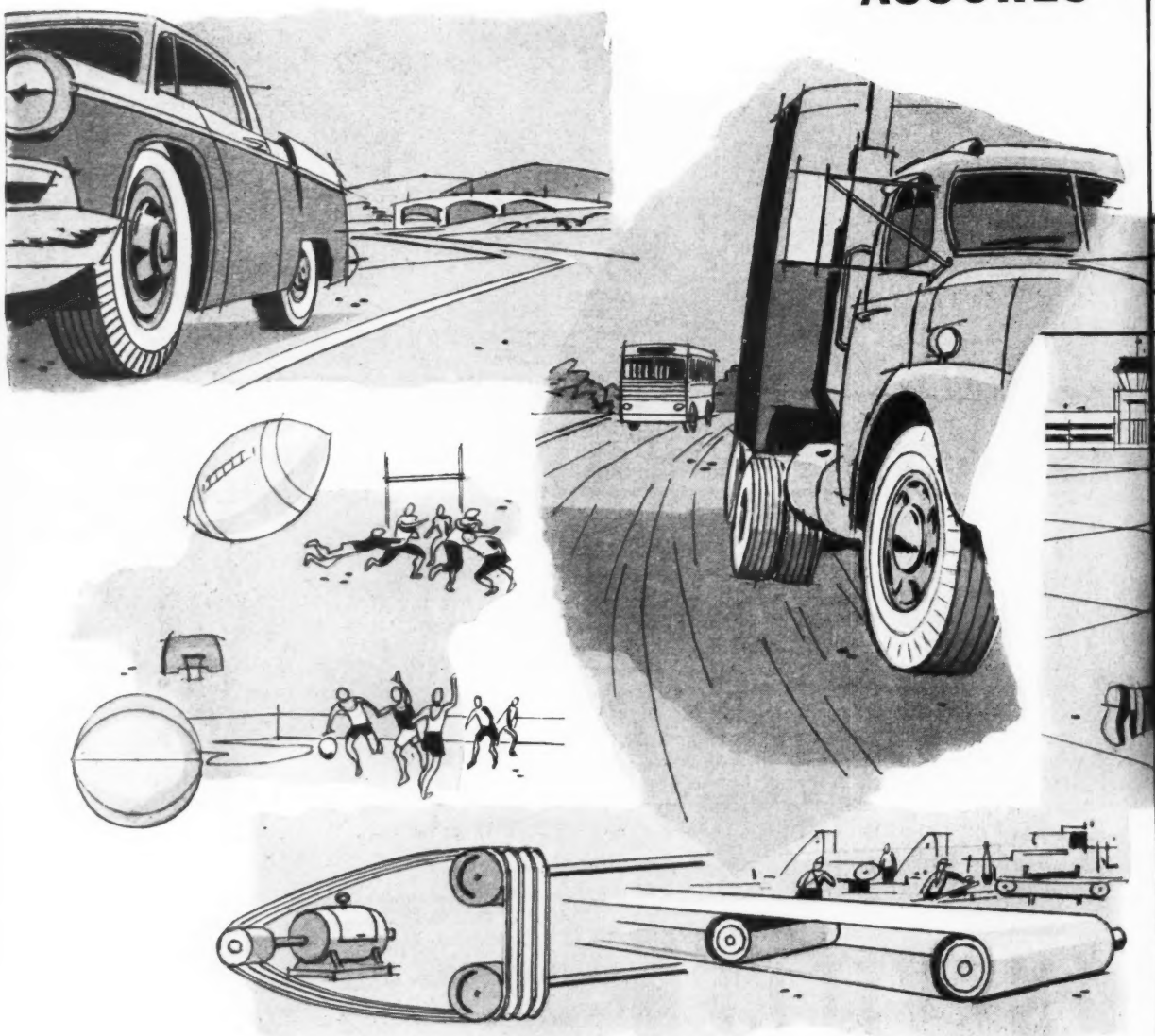
COMPANY

ADDRESS

CITY NC-37-RW STATE

GEN-TAC

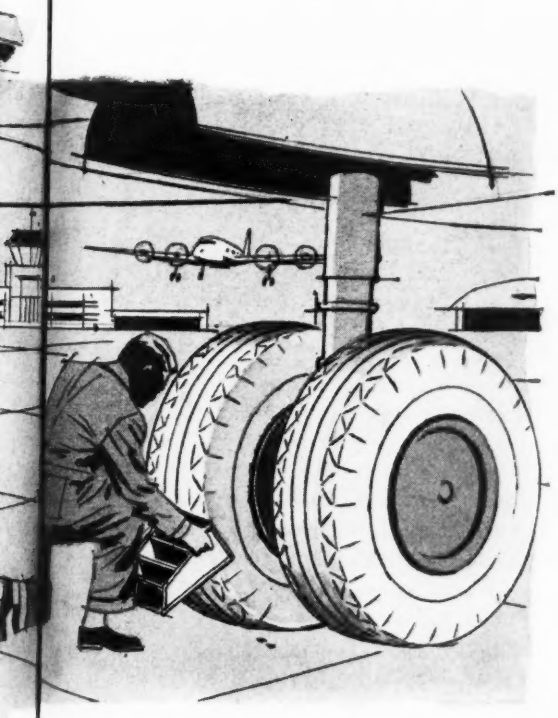
ASSURES



Creating Progress

the
universally-accepted
cord adhesive

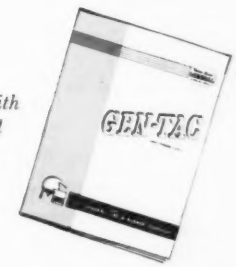
MAXIMUM RUBBER-TO-FABRIC ADHESION



The rubber industry's problem of achieving better adhesion to meet today's high-speed needs is being solved everywhere by Gen-Tac. This unique vinyl-pyridine latex, added in minimum quantities to fabric dips, provides vastly superior bonds between rubber stock and rayon *or* nylon fabrics. Fabric thus treated assures improved fatigue resistance, reduction of curing blows, and fewer ply separations in service.

Manufacturers of airplane, truck, bus and passenger tires, V-belts, hoses, inflatable rubber products, and industrial goods in every part of the world have tested and adopted Gen-Tac as the truly universal solution to adhesion problems. If you manufacture rubber products containing fabric reinforcement, Gen-Tac offers a valuable contribution to product improvement.

Write for this new bulletin, packed with valuable information on Gen-Tac and the many advantages it affords.



THE GENERAL TIRE & RUBBER COMPANY
Chemical Division, Akron, Ohio

Through Chemistry

Chemical Division
GENERAL
THE GENERAL TIRE & RUBBER CO.
GEN-TAC®

SPADONE
BALE CUTTERS

★ Automatic ★ Bench Type
★ Standard

A Model For Every Requirement

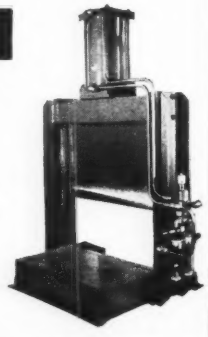
Cut Bales of Crude, Synthetic, Reclaimed Rubber . . . Plastics and Resins.

NEW

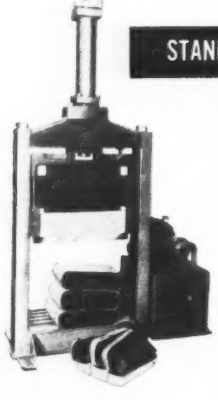
FULLY AUTOMATIC 29″

Automatically feeds, measures and cuts bales. Discharges cut pieces to take-away conveyor or tote box. Slice thickness adjustable from 2" to 6". Knife cuts on continuous time cycle or can be manually operated if desired. A fully self-contained unit. Knife 29" — stroke 23".

SMALL BENCH TYPE 24″



For laboratory use or compounding at Banbury.
Cuts full size synthetic Bales or Pre-cut Crude Rubber.
Air operated cushion action knife actuated by dual electric safety controls.
Easily mounted on Bench or Table — Knife 24" — stroke 12".



STANDARD 29″ & NEW 50″ MODELS

Cuts without lubricant.
Bales are advanced on rollers and can be cut into 1" minimum slices.
Cutters are manually operated and safety control valve requires operator to stand clear while knife is in motion.
Knife 29" — stroke 23" or knife 50" — stroke 36".

Write for details today — Your inquiries will have our prompt attention.

SPADONE MACHINE CO. INC.

SOUTH NORWALK, CONN. PHONE: VOlunteer 6-3394

THE CARTER BELL MFG CO
SINCE
CARTER BELL PRODUCTS
1903
SPRINGFIELD, NEW JERSEY

Vulcanized
vegetable oils rubber substitutes

Types, grades and blends for every purpose, wherever Vulcanized Vegetable Oils can be used in production of Rubber Goods — be they Synthetic, Natural, or Reclaimed.

A long established and proven product.

THE CARTER BELL MFG. CO.
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Represented by
HARWICK STANDARD CHEMICAL CO.
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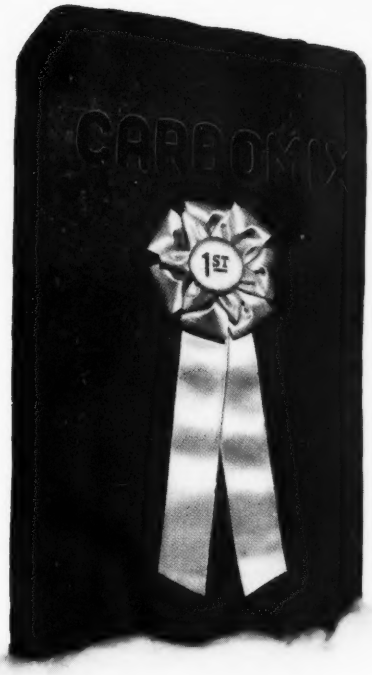

1958

1st *to be commercially available to you!*

1959

1st *to double capacity to meet your demands!*

In April 1958 Copolymer Rubber & Chemical Corporation went into full scale production of **CARBOMIX,** the **FIRST** dispersant-free carbon black masterbatch commercially available to the rubber industry. Our original capacity for **CARBOMIX** was adequate to meet anticipated requirements. However, the superior quality and performance of **CARBOMIX** resulted in its immediate acceptance far beyond original estimates. To meet this increased demand, Copolymer now becomes the **FIRST** plant to double its capacity for this type of black masterbatch while maintaining the same level of production of non-pigmented polymers and latices.

Your inquiries will be welcome.

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COPOLYMER RUBBER & CHEMICAL CORPORATION

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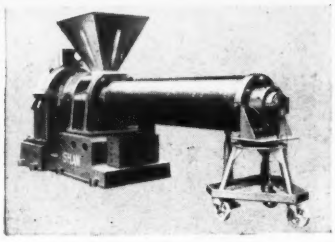
FRANCIS SHAW

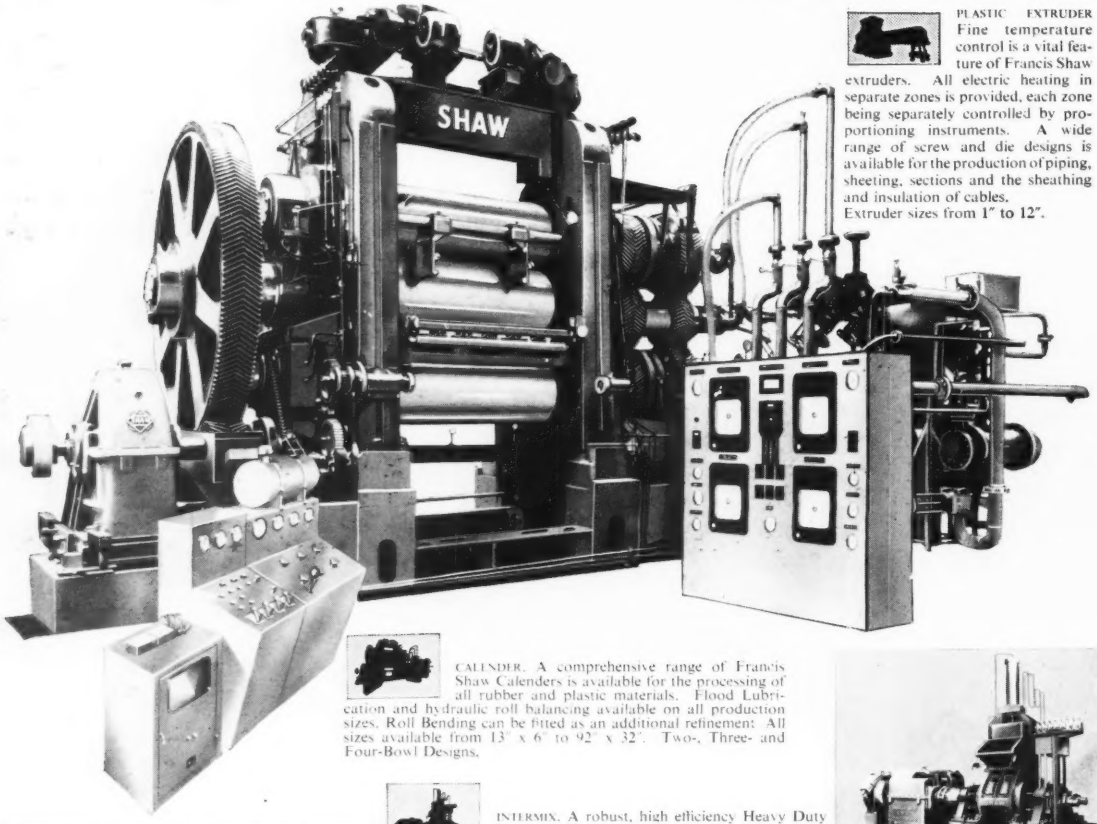
quality engineering puts efficiency into Shaw machines

The cost-cutting performance of every Francis Shaw machine and its thorough dependability are the result of long experience and unvarying high standards of engineering in every detail of manufacture.

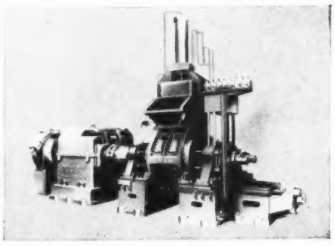
Close-limit accuracy and rigorous inspection during manufacture guarantee to the user a consistently high quality output from Francis Shaw equipment.



PLASTIC EXTRUDER Fine temperature control is a vital feature of Francis Shaw extruders. All electric heating in separate zones is provided, each zone being separately controlled by proportioning instruments. A wide range of screw and die designs is available for the production of piping, sheeting, sections and the sheathing and insulation of cables.
Extruder sizes from 1" to 12".



CALENDER. A comprehensive range of Francis Shaw Calenders is available for the processing of all rubber and plastic materials. Flood Lubrication and hydraulic roll balancing available on all production sizes. Roll Bending can be fitted as an additional refinement. All sizes available from 13" x 6" to 92" x 32". Two-, Three- and Four-Bowl Designs.



INTERMIX. A robust, high efficiency Heavy Duty Internal Mixer for mixing plastic compounds at lower-than-normal temperatures. It is supplied with steam heating for plastics and other materials, and the exclusive rotor design ensures consistent high quality mixing.

FRANCIS SHAW

QUALITY ENGINEERING FOR QUANTITY PRODUCTION

Francis Shaw are available for the design, manufacture, and installation of a wide range of processing equipment

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TELEPHONE NELSON 4-2350 TELEGRAMS CALENDER BURLINGTON ONTARIO

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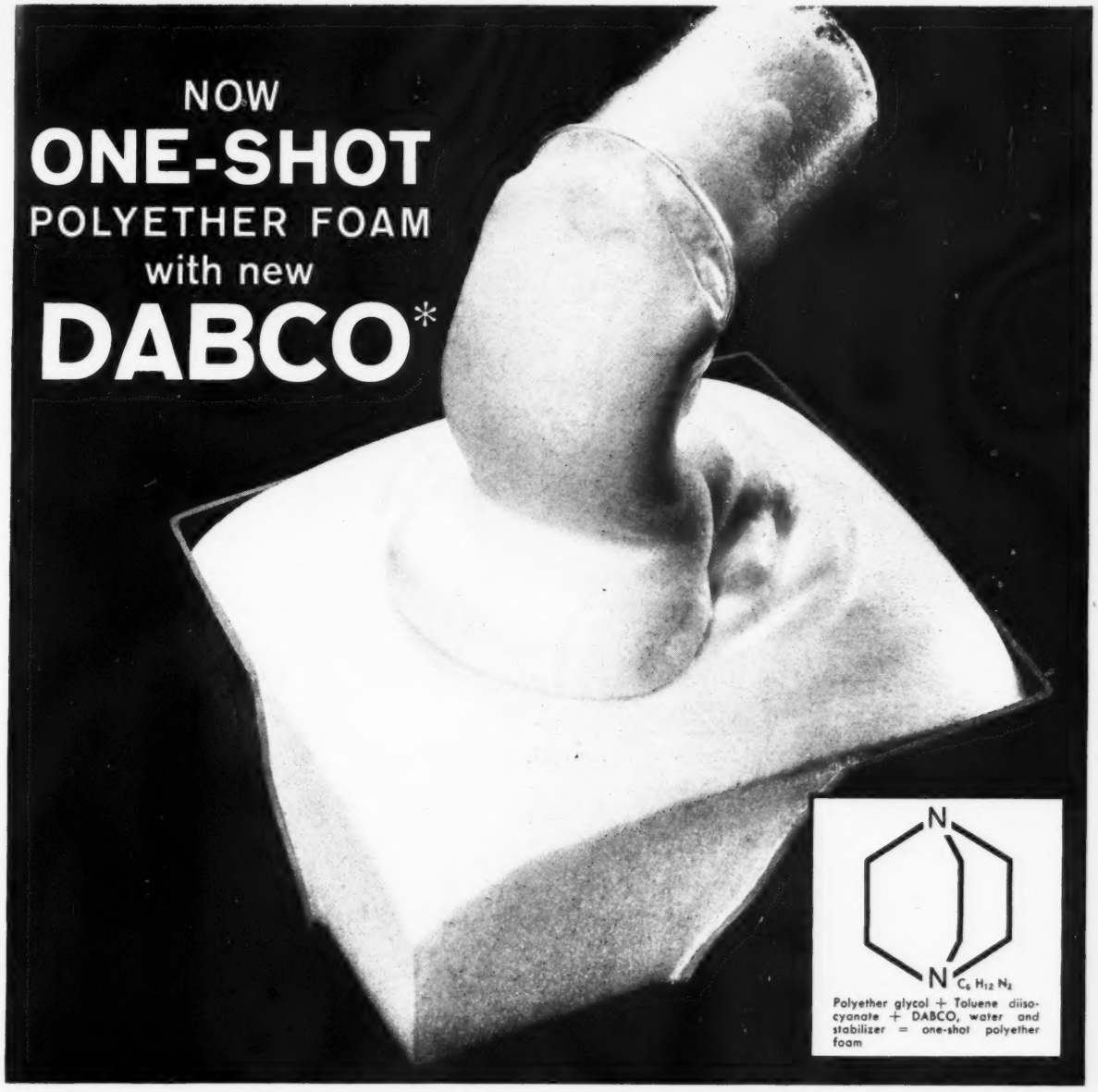


Now, you can produce odorless, flexible, semi-rigid or rigid urethane foams from all commercial urethane grade polyols . . . *in one simple, economical operation.* New DABCO gives you these production advantages:

- Fast cure • Prepolymer step eliminated
- Process in existing equipment
- Low catalyst concentration economy

DABCO produces foams with such good physical properties as:

- Low compression set • Uniform cell structure
- Excellent tensile, tear strength and elongation
- Dimensionally stable • Resistant to humid aging
- Good molding characteristics • No odor

DABCO is now used commercially here and abroad to produce polyether prepolymer and adipic acid ester type crash pads and polyether prepolymer and dimer acid ester foams for seating and load-bearing applications. Other fields are being explored for new DABCO, for which your inquiries are invited.

Write for complete information.

*HOUDRY PROCESS CORPORATION TRADEMARK FOR TRIETHYLENEDIAMINE

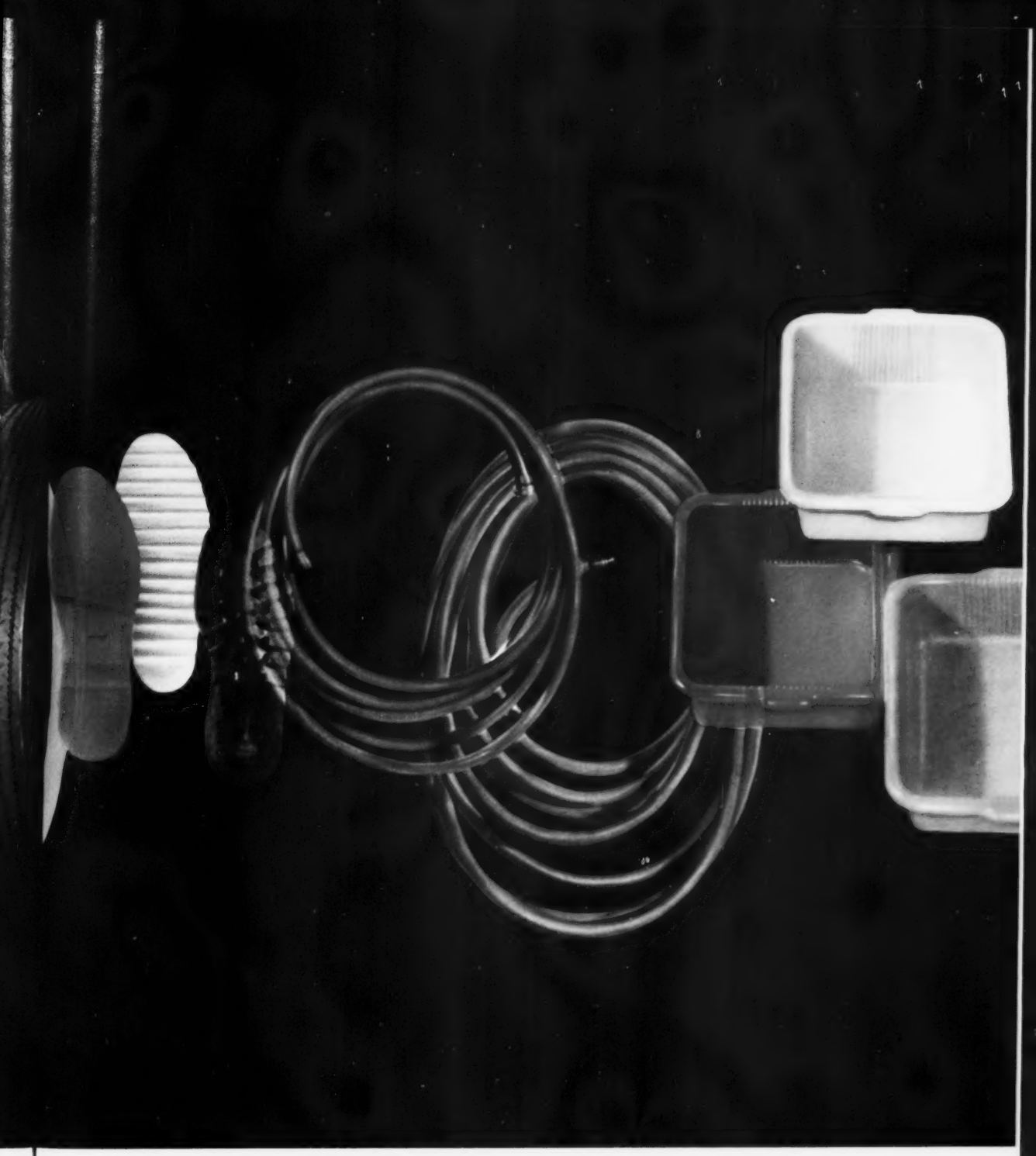
The structure and properties of DABCO suggest the following other possible areas of interest:

- Chain transfer agent in radical catalyzed polymerizations
- Activator for peroxide catalyzed polymerization
- Transesterification and cyanoethylation catalyst
- Complexing agent for metals

HOUDRY
PROCESS CORPORATION
1528 Walnut Street, Phila. 2, Pa.

HOUDRY means Progress . . through Catalysis

HI-SIL®, CALCENE®, & SILENE® CREATE COLORED GOODS THAT MOVE



Sports equipment, housewares, soling, automotive products . . . bright sales and profit pictures for manufacturers of colored rubber goods make it obvious: color is here to stay—and the more products of all types color's appeal enhances, the better consumers and retailers like it.

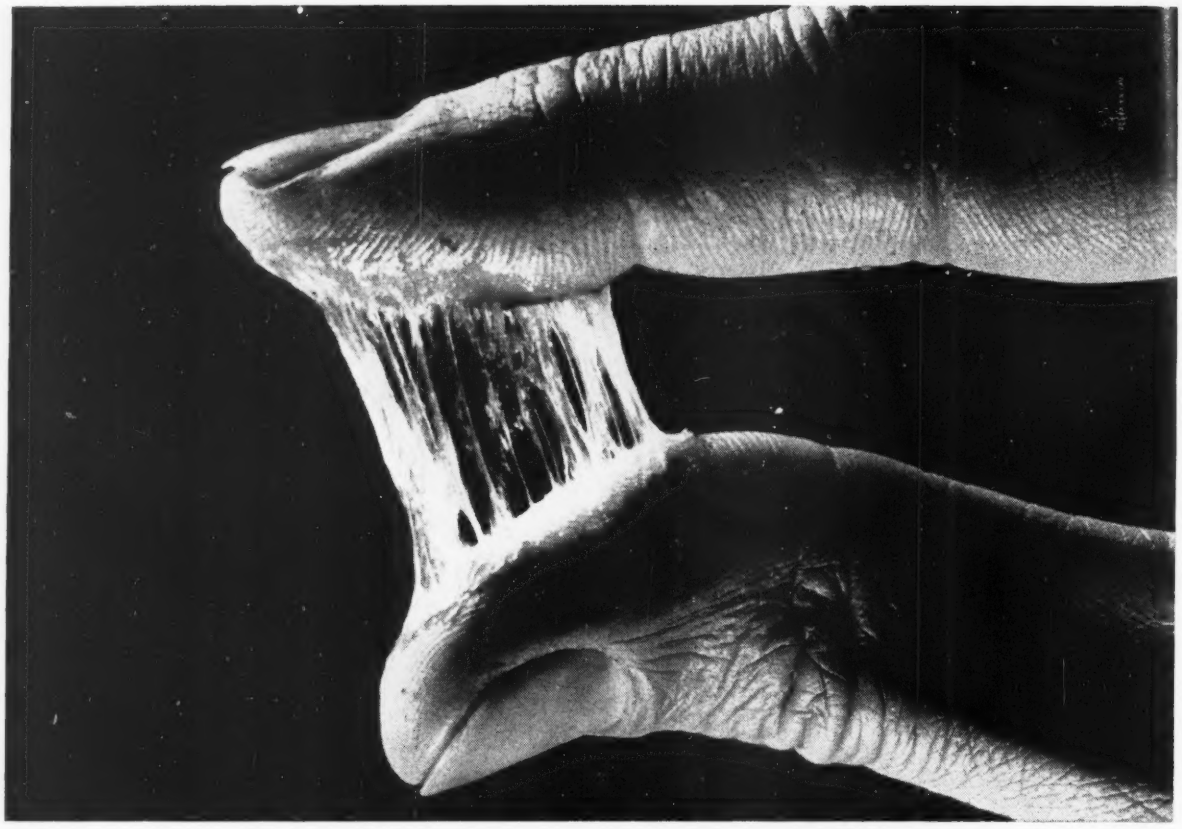
Hi-Sil, Calcene and Silene make color practical. These three exceptionally high quality white reinforcing pigments from Columbia-Southern permit uniform production of white stocks that take subtle pastels, vivid brights, rich deep tones—accompanied by excellent physicals to stand up under extreme degrees of punishment.

A brand-identifying color might well make *your* goods move faster. If you've already switched to color, upgrading specific properties with Hi-Sil, Calcene or Silene could be helpful. For individual formulation assistance, just address us at Pittsburgh or the nearest of our fourteen District Sales Offices.

Columbia-Southern Chemical Corporation, One Gateway Center, Pittsburgh 22, Pennsylvania. Offices in principal cities. In Canada: Standard Chemical Limited.

COLUMBIA-SOUTHERN CHEMICAL CORPORATION

A Subsidiary of Pittsburgh Plate Glass Company



Now—give neoprene cement a tighter grip, longer tack, more heat resistance.

Add a pinch of permanence—Durez 19428

Some interesting things happen to neoprene solvent cement when you add *Durez 19428*, new heat-reactive phenolic resin produced by the same research and development that made the familiar *Durez 12603* so generally accepted.

In a typical cement formulation, *Durez 19428* added to neoprene steps up adhesion to synthetic fibers such as Dacron, nylon, and rayon—and provides a tighter grip to glass, metals, and unplasticized plastic films, as well.

Add *Durez 19428* resin and a small amount of magnesium oxide, and the uncured cement bond becomes more resistant to heat. Its heat resistance grows as you add more resin. The bond becomes even more heat resistant if cured at 200° F.

Longer tack retention, better fabric life

In a cement formulated for good initial tack and tack retention, adding *19428* prolongs the tack retention period. The resin also minimizes the tendency of bonded fabrics, such as cotton and rayon, to deteriorate in sunlight. As little as 10 parts of *19428* per 100 of neoprene can retard the tendency of many cements to change viscosity when stored.

You'll find this new resin has good compatibility with all types of neoprene. It has infinite solubility in toluene, VM&P naphtha, methyl ethyl ketone, acetone, and carbon tetrachloride, and is soluble up to 12.5% resin solids in mineral spirits.

The resin is stable and stores well in cool, dry conditions. It comes to you in crushed form, in standard 51-gallon fiber drums containing 325 lbs. net.

To see what *Durez 19428* can do for your cement formulations, use the coupon now to request a sample. Ask also for Service Bulletin 305, which describes the recommended compounding and mixing methods.

What can this new resin do for your neoprene cement? To find out quickly, check here. We'll send you:

☐ Evaluation sample of *Durez 19428* ☐ Technical data sheet
☐ Service Bulletin 305—compounding and mixing suggestions

Clip, attach to your business letterhead, with your name, title, company address, and mail to us today.

DUREZ® HOOKER CHEMICALS PLASTICS

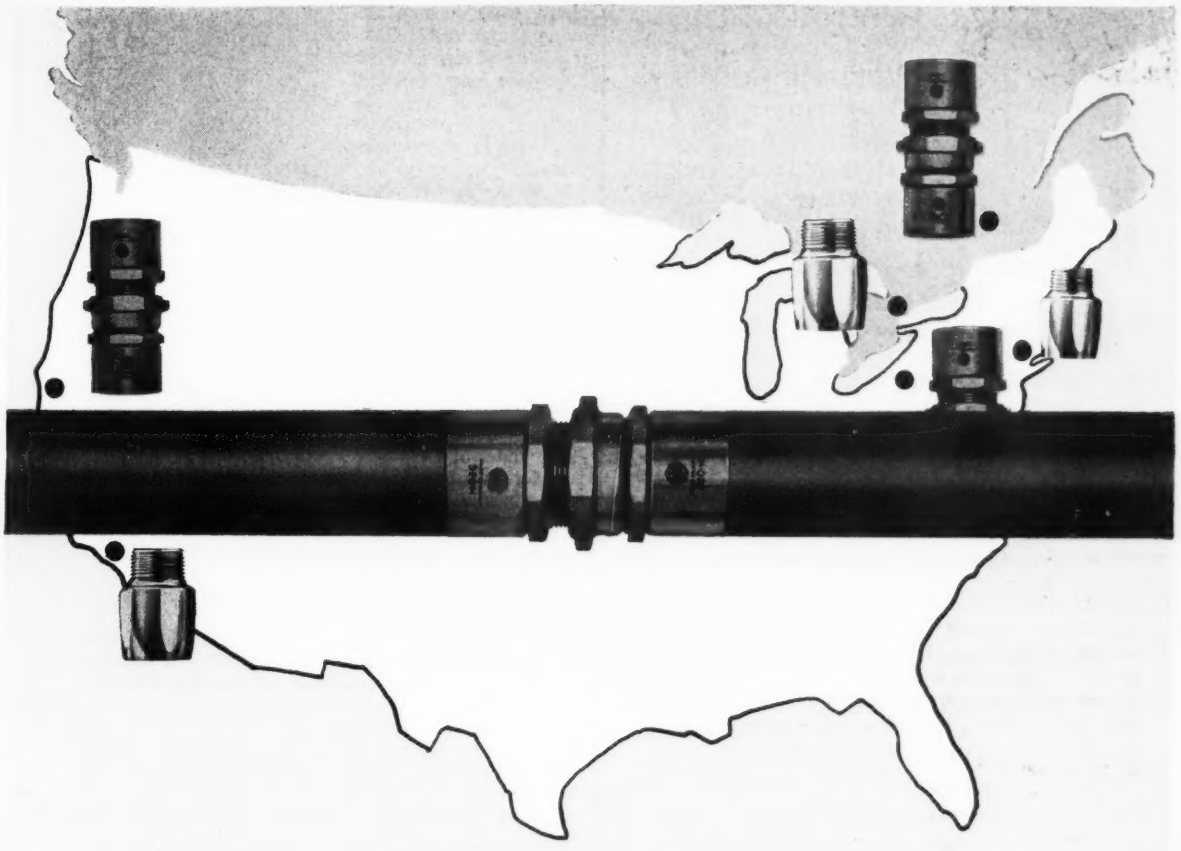
PLASTICS DIVISION
HOOKER CHEMICAL CORPORATION
203 Walck Road, North Tonawanda, N. Y.

IMMEDIATE SERVICE

ANYWHERE in U.S. & Canada. Scovill's nation-wide facilities provide the industry's fastest service on fuel oil and gas pump couplings!

Only Scovill with its country-wide network of sales offices and warehousing facilities is equipped to give you such fast . . . efficient service. All orders for fuel oil and gas pump couplings received by Scovill are shipped *promptly*. And the sizes you want are always *immediately* available. That's because Scovill makes and stocks a complete range —from ¾" to 3" in fuel oil couplings . . . and all standard sizes in gas pump couplings.

The largest—and finest—sales and service force in the industry is ready to consult with you anytime, anywhere when you specify Scovill couplings. And—because you can buy *direct* from Scovill—you save up to ⅓ the former cost of oil and gas pump couplings. Get complete details now. Write: Scovill Manufacturing Company, Hose Coupling Department, Waterbury 20, Connecticut.



Hose couplings by **SCOVILL**

Main office: 99 Mill Street, Waterbury, Connecticut Cleveland: 4635 W. 160th Street Los Angeles: 6464 E. Flotilla Street Houston: 2323 University Blvd.
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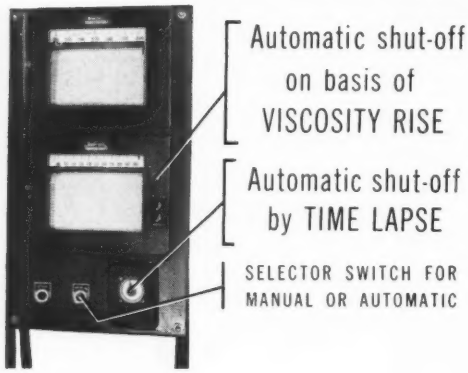
SAVE 75%
OF OPERATOR'S TIME

ON YOUR

SCOTT STI or NBS
MOONEY VISCOMETER

with these
Automatic Controls



These automatic controls, when applied to your Mooney recorder, save 75% of operator's time. The operating sequence is:

1. **Load machine.**
2. **Push START button.**
3. **The automatic controls take over as follows:**
   a) **1-minute warm-up.**
   b) **Recording commences and continues until Viscometer is shut off on basis of VISCOSITY RISE and/or TIME.**
   c) **Viscometer shut-off stops recorder.**

Applicable to YOUR Scott Mooney

If your recorder does not have these controls, contact us for advice. (This automatic operation is in complete conformance with ASTM Methods D 927 and D 1077.)

Request new "CRE Bulletin"

SCOTT TESTERS, INC.
90 Blackstone St., Providence, R. I.

Representatives in Foreign Countries

New Symbol of World-Standard Testing

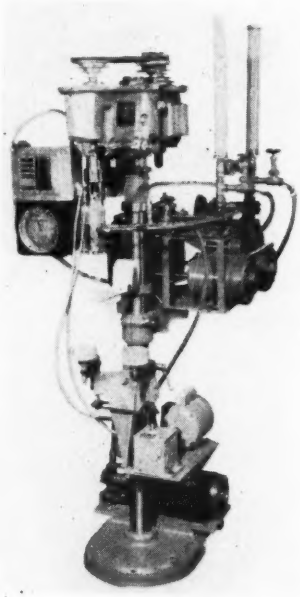
NEW EQUIPMENT

Polyurethane Foam Mixers

Sterling Alderfer Co., Akron, O., is now building and marketing polyurethane foam mixers for the continuous production of small-unit molded foam goods. The mixer is constructed to run small continuous quantities with a variation not over one-half gram per minute. This mixer is said to be self-flushing and can be started and stopped in a matter of one or two minutes.

The machines are completely equipped with metering pumps, test containers, self-flushing and quick removable foam head, and other features. The machines are particularly adapted for producing foam for molding as they are equipped with semi-automatic molding units.

Interested purchasers should let the manufacturer know what product they wish to make, as the manufacturer will produce the first samples on a machine which would be built and tailored to the product in mind.



Alderfer polyurethane foam mixer

Some of the first orders for the Alderfer polyurethane foam production machines came from the Pirelli Rubber Co., Milan, Italy, and from a new producer in Ireland. Others are being built for firms here and abroad. The machines are recommended by the manufacturer to concerns entering the field of molded polyurethane foam production.

JMC Two-Roll Lab Mill

JMC, Newark, N. J., has designed and put into production a six- by 13-inch two-roll laboratory mill with four-inch bearings. The company claims that these bearings, reported to be the largest used in this type of machinery, will assure a sturdier roll with less roll deflection. The bearings can be removed individually for replacement without taking the mill apart.

Streamlined and sturdily constructed, the JMC laboratory mill has cast-steel top cap frames to hold bearing boxes and rolls; automatic tilt-type check plates to facilitate cleaning of rolls and prevent color contamination; automatic pressure lubrication to journal boxes; and automatic drip lubrication to chain drive and connecting gears. The factory can also provide oil circulating temperature controls to provide the rolls with temperatures up to 450° F.

The JMC mill is driven by a 7.5 hp., three-phase, 60-cycle, 220/440-volt ball-bearing motor and gear drive. The motor and the roller chain drive provide a back roll speed of 30 rpm. and are fully enclosed in the base. All vulnerable parts are com-

Growing with the rubber industry...

THE CYANAMID RUBBER PIGMENTS FAMILY!

New uses for rubber and foams are devised every day . . . and *attractive color* is the secret in selling these new products. Nothing sparks the buying impulse like color . . . and there's no better, more reliable way to supply that attractive color than with Cyanamid Pigments!

Whether your interest lies in the cool blues and greens of the Cyan phthalocyanine family or in the warmer reds and yellows, you'll find the *exact* toner you need in Cyanamid's complete range of rubber colors. What's more, each of these Cyanamid toners has inherent chemical and physical properties that make it wonderfully suited for rubbers and foams. From batch to batch, these toners give uniform—and *beautiful*—results . . . results that add to the *eye appeal* and the *sales appeal* of your products.

Your Cyanamid Pigments representative would be pleased to show you the advantages and economies of any of the Cyanamid quality pigments for rubber. Ask for samples, too!

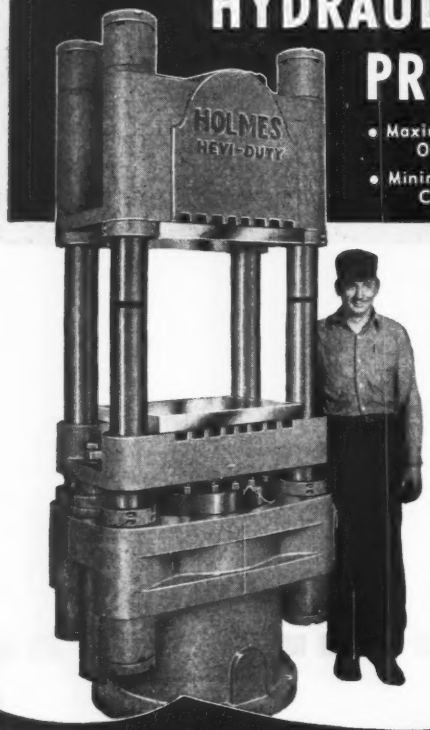
CYANAMID

AMERICAN CYANAMID COMPANY
Pigments Division
30 Rockefeller Plaza · New York 20, N. Y.
Branch Offices and Warehouses in Principal Cities

COLOR IS THE DIFFERENCE

Now... PRECISION MOLDING
is NO PROBLEM
with the new and improved
HOLMES
HYDRAULIC
PRESS

- Maximum Output
- Minimum Cost



New Features--Precision Results

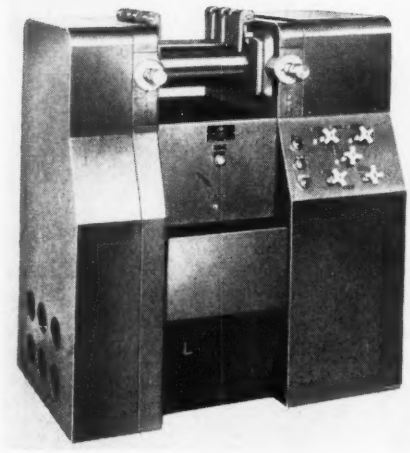
The new and improved Holmes Hydraulic Press retains all the features of its famous predecessors... PLUS...many outstanding improvements. These put it in a class by itself--for all kinds of general purpose work...and...special production where close tolerance is required. Low in price. Practically no maintenance. Will quickly pay for itself in any processing plant.

WRITE OR WIRE FOR SPECIFIC DETAILS--regardless of your particular requirements. With 52 years know-how specializing in machinery and molds for the rubber industry--Holmes can help you solve your problems, too, just as they have for so many others. No obligation, of course.

SEND FOR ILLUSTRATED FOLDER...TODAY

Stanley H. HOLMES Company
Successor to Holmes Brothers, Inc.
3300 W. Lake Street, Chicago 24, Illinois

New Equipment



JMC six- by 13-inch mill

pletely guarded, but readily accessible for maintenance, lubrication, and repair.

Additional information is available from the company.

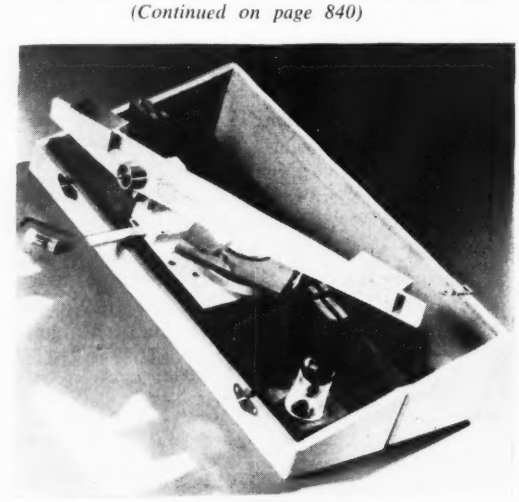
Shear/Scratch Tester

The Model 203 shear and scratch testing instrument, manufactured by Taber Instrument Corp., North Tonawanda, N. Y., is a device for testing the surface quality of organic materials and plastic coated surfaces to resist digs, scratches, scrapes, and similar physical damage not classified as normal wear.

With the instrument, the shear test is performed with a finely balanced scale beam calibrated in grams to which is attached the Taber S-20 precision ground contour shear tool. The cutting edge is lapped to a 25-millimeter radius with a 30-degree clearance and is set at a 22-degree shear angle in relation to the motion of the specimen. This tool is designed to cut a groove up to 0.100-inch in width, and the width is dependent on the depth of cut. The scratch test is performed by using either the No. 139-58 perfect cube point diamond tool or the No. 139-55 conical point diamond tool which are interchangeable in the mounting.

The graduations on the scale beam are wide and legible and represent 10 grams per graduation. The sliding weight provides

(Continued on page 840)



Model 203 Taber shear/scratch tester

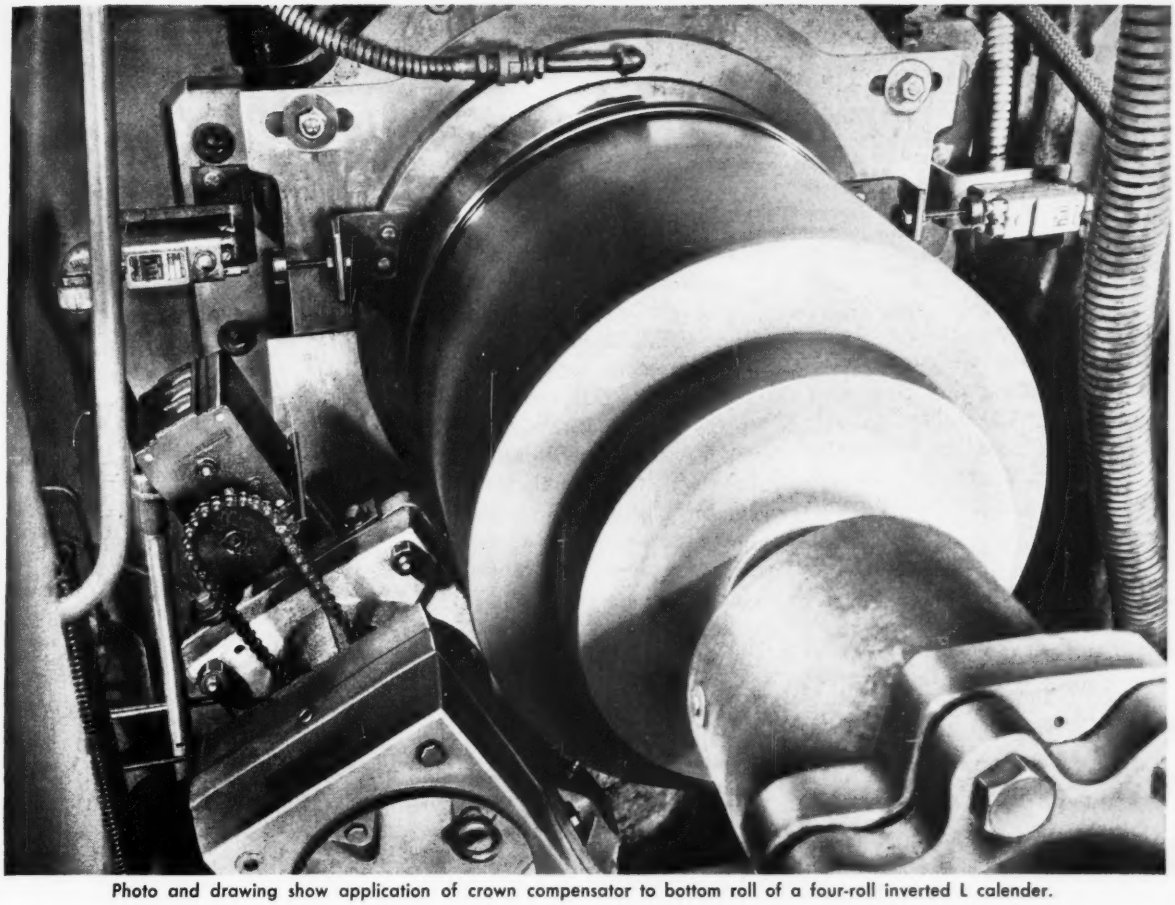


Photo and drawing show application of crown compensator to bottom roll of a four-roll inverted L calender.

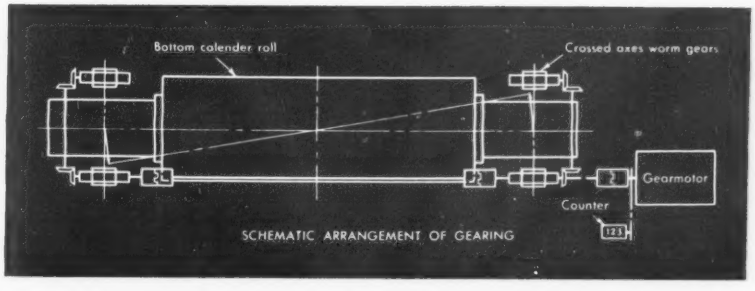
Farrel crown compensators prove their efficiency on existing calenders

Twelve recent installations of Farrel's new crown compensator emphasize the benefits available to users of this mechanism. Each has resulted in far better gauge control over a greater range, as well as improved lay-flatness of the material being calendered.

The crown compensator has been developed by Farrel to apply, at moderate cost, the crossed-axes principle of roll-crown control to existing calenders having connecting gears mounted on the rolls. The device consists of complete new bearings for the roll to be crossed, a new swivel connecting gear for this roll, and a small gearmotor for varying the amount of crossing. Adjustments are made by push-button control.

Send for further information about this important new development. Ask for folder A58-DM9 which describes the crown compensator in detail.

FARREL-BIRMINGHAM COMPANY, INC.
ANSONIA, CONNECTICUT
Plants: Ansonia and Derby, Conn., Buffalo and Rochester, N. Y.
Sales Offices: Ansonia, Buffalo, Akron, Chicago, Ann Arbor (Mich.), Los Angeles, Houston, Fayetteville (N. C.)
European Office: Piazza della Republica 32, Milano, Italy



FARREL

FB-1161

Here's how UOP 88® and ...to protect your rubber

What you need to know about antiozonants today

When UOP 88 or UOP 288 is compounded into your rubber products, deterioration of the polymer by exposure to ozone is prevented by action of the UOP chemical antiozonant which continually migrates to the surface of the rubber article and there acts as a sacrificial ozone scavenger.

That's nutshelling it for you. Behind this simplification of how UOP 88 and 288 work is a vast network of factors to be taken into consideration. How long and how well the antiozonants will work for you depend on a knowledge of the differences in antiozonants and the factors involved in compounding.

Knowing the difference

Antiozonants vary widely in type and composition. One material may give quite satisfactory protection under static conditions but fail miserably under even modest flexing. Another will provide mediocre protection in static or dynamic service. UOP 88 and 288 however provide excellent ozone protection to rubber goods in storage and in use.

Proper application is almost as important as antiozonant selection. A windshield wiper blade formulation, tire compound or gasketing recipe will differ—sometimes widely—in composition; the service conditions of the finished article are equally diverse. In making recommendations for ozone protection all these factors must be evaluated. The conditions of use and service are of utmost importance in selecting the amount and means of antiozonant protection.

At Universal Oil Products Company some of the country's most able research scientists and technicians work constantly testing and improving the UOP family of antiozonants.

What influences effectiveness

Effectiveness of antiozonant compounds may be influenced by these major factors:

1. Type of polymer, natural or synthetic
2. Curing system used
3. Reinforcing agent used
4. Concentration of the compounding ingredients, including the antiozonant
5. Conditions under which the product is to be used, including:
   a. type of stress encountered (fixed or intermittent)
   b. ozone concentration
   c. temperatures

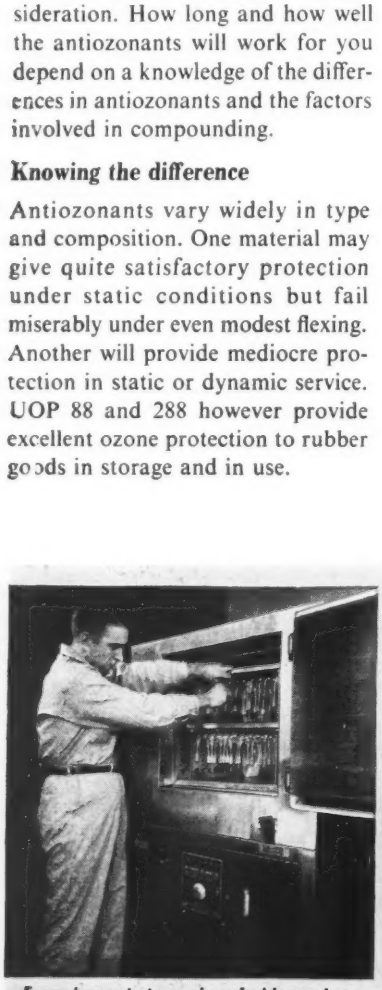
When the product is to be vulcanized, the choice of curing system is the most important single factor in obtaining maximum antiozonant performance. The formulation being used must be suited to the curing system or much of the antiozonant's protective action will be lost in vulcanization.

The type and concentration of carbon black used as a reinforcing agent also plays an important part in retention of antiozonant efficiency through the vulcanization phase.

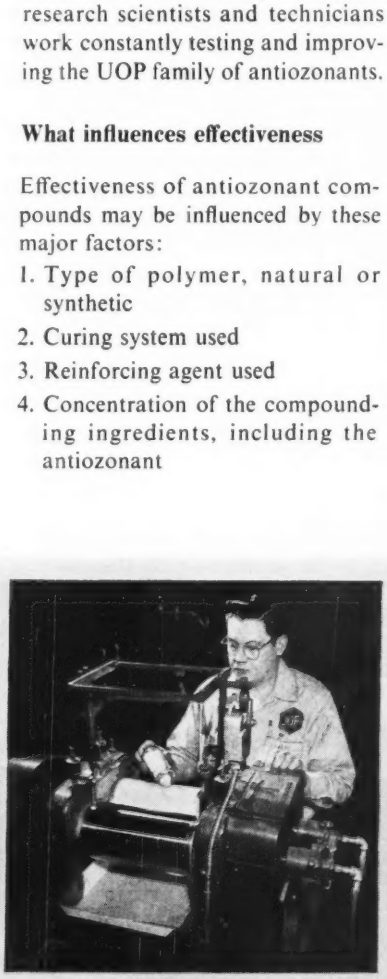
The concentration levels of the antiozonant must be related to other ingredients of the compounding recipe and to exposure conditions. Variations in type or concentration of ingredients reduce or enhance the final, lasting effectiveness of the antiozonant.

So you already use an antiozonant

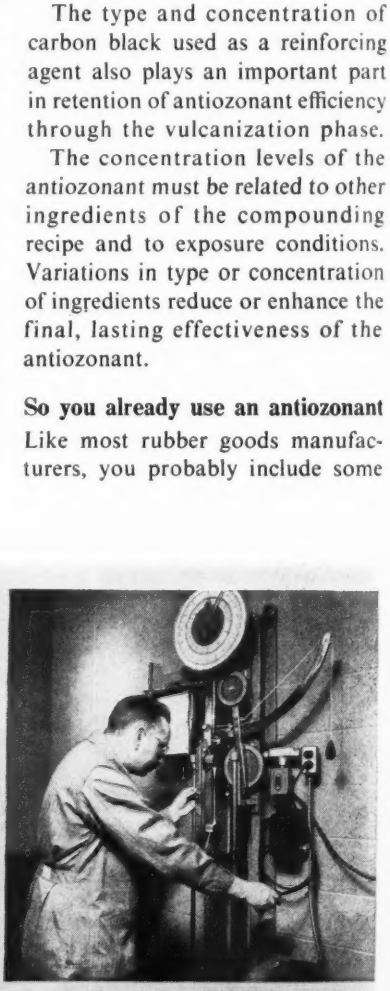
Like most rubber goods manufacturers, you probably include some



Every day we test a number of rubber recipes. Exaggerated conditions of stress and ozone concentration in the oven assure complete protection under any normal conditions.



In the Universal rubber laboratory, a rubber mill is used to incorporate experimental UOP antiozonants in various rubber polymers.



The Scott Tester is used to measure physical properties of an experimental vulcanizate.

288® work products

kind of antiozonant compound in your product formula. What you may not know, however, is that the ozone damage problem is becoming progressively more acute and not all antiozonant compounds can cope with the increasing ozone levels. What served as effective antiozonant protection even a few years ago is inadequate today. Reported instances of deterioration of rubber goods due to ozone attack are often quite dramatic. In the Los Angeles area, where the ozone concentration is high, an unprotected rubber article may actually show ozone damage in a few days. In other large cities where ozone levels are not so high, ordinary base stocks may crack in a year or less even under static conditions.

UOP researchers have worked unceasingly and successfully to keep UOP 88 and UOP 288 compounds up to the demand placed on the antiozonant for utmost protection against this spiralling ozone load.

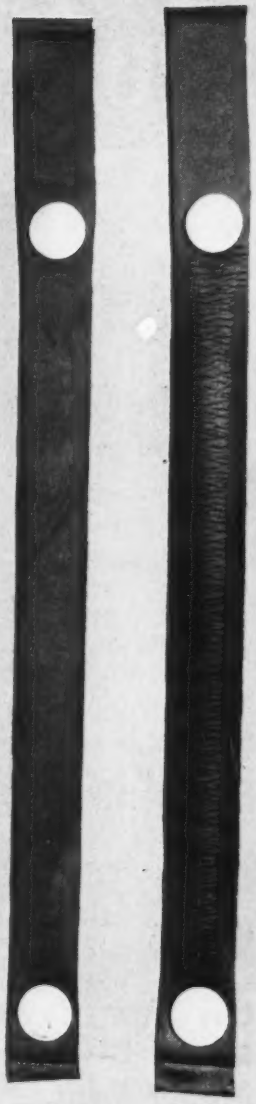
Here's proof

The UOP research laboratories are the scene of a daily battle against ozone. Through continuous research and arduous testing of thousands of antiozonant formulations in a variety of base stocks, you may be assured of absolute protection of your products when you use UOP 88 or UOP 288. In addition, many manufacturers have tested UOP antiozonants in their own laboratories and in use, have proved them to be superior. One of our tire customers recently reported that in a test of UOP 88 in their base stock, the UOP antiozonant afforded complete protection for 230 hours of exposure under fixed conditions of strain at 50 pphm ozone . . . much greater strain and ozone concentration than the tire would ever be subjected to in normal use. Comparatively, another antiozonant, used in the same recipe, failed and the tire cracked after only 30 hours of exposure. As a further basis of comparison, the unprotected base stock cracked in 5 hours.

How about your product?

You will get surer, more lasting protection of your rubber products with UOP 88 or UOP 288. For one little penny per pound of base stock these UOP antiozonants will perform for years to prevent ozone cracking, even under severe atmospheric exposure.

All UOP facilities and technical personnel are at your disposal for counseling on your particular antiozonant needs. A phone call, letter or wire will put them to work for you right away.



Rubber Strip Tests Show Effectiveness of UOP Antiozonants

The two rubber strips above were inserted in an ozone cabinet under identical, controlled conditions. The rubber in the sample shown on the right did not contain an antiozonant and reveals marked ozone damage. The SBR sample on the left contains two parts phr of a UOP antiozonant and reveals no ozone cracking after equal exposure.

UOP 88® and 288®

RUBBER ANTIOZONANTS

UOP®

UNIVERSAL OIL PRODUCTS COMPANY

30 Algonquin Road, Des Plaines, Illinois, U.S.A.

STOP "SCORCHING"

Get COOLER Mixing
Better Dispersion
Bigger Banbury loads with

RECLAIMATOR

Profit-building RECLAIMS

● Scorched compounds cost you money, time and frayed nerves. With RECLAIMATOR Reclaims, you get cooler mixing, better dispersion and right plasticity. Moreover, you get higher **output** because of 10% greater batch size **and** 1-½ more batches per Banbury hour !

Let us know your specific compounding problems.

Write For Illustrated Literature 21

U. S. RUBBER RECLAIMING CO., INC.
P.O. BOX 365 BUFFALO 5, N. Y.

NEW PRODUCTS

Foreign Car Tires

The Firestone Tire & Rubber Co., Akron, O., has announced the addition of a ninth tire size to its line of tubeless tires for imported cars. The new tire, a 5.0-15, is designed for the French built Renault Dauphine and is made in both black and white sidewalls.

The nine tire sizes now in the Firestone line cover approximately 95% of the foreign-made cars operating in this country. All of the tires are manufactured in the United States.

Other sizes available are: 5.00-14, 5.20-13, 5.60-13, 560-15 5.90-13, 5.90-15, 6.40-13, and 6.70-13.

Barr Hi Vue Balls

The Barr Rubber Products Co., Sandusky, O., has introduced its Hi Vue clear plastic toy balls decorated in brilliant colors. This decoration only partially covers the plastic, thus permitting a see-through effect. In motion, light is reflected and let through, giving a sparkling and glowing effect.

Hi Vue clear vinyl plastic balls are made in three styles—Scroll, Pinwheel, and Parastripe. They are available in three sizes, diameters of 4⅜, 5½, and 6½ inches. Complete details are available from the company.

New Painters' Glove

A new lightweight glove for painting, called Nimble Fingers, has been introduced by The Pioneer Rubber Co., Willard, O. These tissue-thin, liquid- and paint-proof gloves with their non-binding design and finger-touch sensitivity give the wearer bare-hand comfort and a smooth fit, it is claimed. They keep the hands clean and also protect the wrists and lower arms.

Made of Pylox, a special vinyl compound developed by Pioneer, the gloves are said to have unusually high non-allergic properties. Also, this sheer, featherlight material makes it easier to slip the gloves on and off. When a non-slip grip is required, the gloves can be turned inside out so that the textured surface provides the necessary sure hold.

The gloves are offered in a colorful, open-end package design. A specially notched end-flap is designed so that the gloves can be easily displayed on racks and peg boards. Nimble Fingers painters' gloves are available in small, medium and large sizes.

Goodyear Steel Guard Industrial Tire

The Steel Guard Industrial tire, said to be the first pneumatic industrial tire with steel cord breaker construction, is being marketed by The Goodyear Tire & Rubber Co., Akron, O. It features a puncture-resisting barrier of two criss-crossed steel cord breaker strips, locked in placed beneath the tread by a special rubber compound.

The tire, subjected to more than two years of in-use tests, is recommended primarily for use in operations where sharp objects are a hazard, such as in mines, scrap metal yards, steel plants, brick yards, and similar industrial areas.

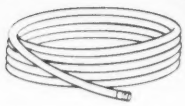
Produced in Goodyear's popular Super Rib and Industrial Lug designs, the new Steel Guard Industrial tire is available in these sizes: 4.80/4.00-8, 6-ply rating, in the Super Rib design; and in the Industrial Lug design, sizes 6.00-9, 10-ply; 6.50-10, 10-ply; 7.50-15, 10-ply; 7.00-12, 12-ply; and 7.50-10, 12-ply.

THE RIGHT RUBBER FOR THE JOB

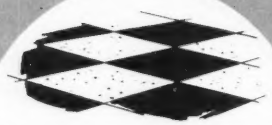
FIRESTONE OFFERS YOU... THIRTY-EIGHT PRODUCT-SPECIALIZED POLYMERS, LARGEST, MOST COMPLETE LINE IN THE INDUSTRY

Twenty-six synthetic dry rubbers and twelve synthetic latices provide the precise product characteristics and production economies you need.

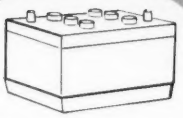
FIRESTONE SYNTHETIC RUBBER AND LATEX COMPANY
DIVISION OF FIRESTONE TIRE AND RUBBER COMPANY
AKRON 1, OHIO



FR-S 1000—An exceptionally versatile general purpose rubber. Gives very good results in most black or dark compounds. Easy processing characteristics, especially useful in making hard rubber products. Successfully used in molded and extruded goods, tire body stocks and treads.



FR-S 1001—Combines good aging properties with only slight stain and discoloration tendencies. Particularly adaptable for use in light-colored shoe soles, heels, floor tiles, moldings and extrusions. Like all FR-S butadiene-styrene polymers, it is easily processed, highly uniform.

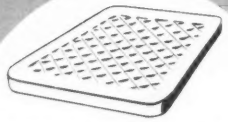


FR-S 1004—Low in water absorption and water-soluble impurities; finds special use in electrical insulation and battery cases, and in products in direct contact with food, such as can-sealing compounds and food jar gaskets. It has good physical properties and ages well.

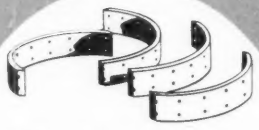
FR-S 1006—A very light-colored non-staining polymer, ideal for white sidewall tires, floor tiles, coated fabrics, shoe soles and household goods. Requires a minimum of expensive white pigment. It lends impact strength to light colored plastics.

FR-S 1007—A relatively new hot rubber, characterized by low water absorption properties. It finds its widest use in electrical application—in wire and cable insulation, but is also a good polymer for a variety of hard rubber articles and gaskets.

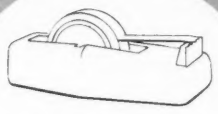
FR-S 1009—A non-staining polymer used with other rubbers to smooth out and speed up calendering and tubing and to avoid distortion of uncured products. It increases dimensional control in the manufacture of insulated wire, hose, calendered sheet goods and coated fabrics.



FR-S 1010—A non-staining, non-discoloring rubber characterized by very low polymer viscosity. Ideal for the manufacture of chemically blown sponge, it cuts milling time, eliminates peptizing agents. Use it when the ultimate in easy processing is needed.



FR-S 1012—High polymer viscosity, combined with solubility in solvents. Widely used for asbestos sheet packing, gaskets, brake lining and high viscosity cement, it is non-staining and offers high tensile strength and high modulus when cured.



FR-S 1013—A special-purpose, high-styrene rubber used in closure and can-sealing compounds. It has a low content of water-soluble impurities, low water absorption properties and relatively high uncured strength. Produces strong adhesives and may be used in contact with light finishes.

FR-S 1014—Made with a resin soap emulsifier; offers exceptionally good tack and green tensile properties. It is widely used in adhesives, can-sealing compounds and industrial tapes.

FIRESTONE NOW OFFERS YOU 26 SYNTHETIC FR-S RUBBERS

Firestone

BETTER RUBBER FROM START TO FINISH

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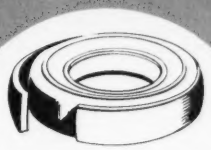
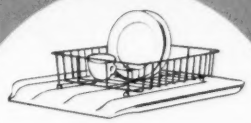
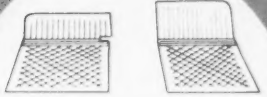


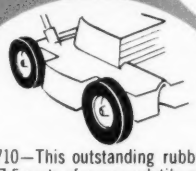
FR-S 1500—Developed from famous "cold rubber" tire tread polymers. Offers desirable physical properties, easy processing and good building tack. Used for camelback, all tire stocks, hard rubber and mechanical goods and any products requiring premium physical properties.



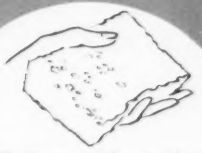
FR-S 1502—A non-staining, light-colored cold rubber; offers finest physical properties for white sidewall tires, kitchenware, hospital goods, sporting goods and coated fabrics. Its high loading capacity and desirable flex resistance make it useful for shoe soles and heels.



FR-S 1703—An oil-extended, non-staining cold polymer; ideal for low-cost rubber products like passenger car floor mats, auto truck mats, shoe soles; 25 parts naphthenic oil based on a special polymer, permits economy of manufacturing without sacrificing physical properties.

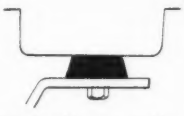


FR-S 1710—This outstanding rubber combines 37.5 parts of a non-volatile aromatic processing oil with a specially prepared polymer. Easily processed; makes for more economical compounding of camelback, tire treads, mechanical goods and molded parts.

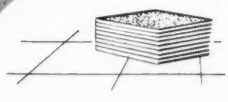


FR-S 127—A non-staining "cold rubber" with a low Mooney viscosity, ideal for chemically blown sponge rubber products. It processes easily without breakdown. It has desirable physical properties and is especially useful where high pigment loading is necessary.

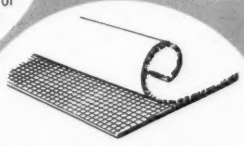
FR-S 123—Features inherently superior stability; eliminates processing variations and viscosity changes caused by aging. Finds wide use in tire treads, camelback, mechanical goods and molded parts. Offers superior carbon black dispersion. Combines 31.0 parts of aromatic oil with a special polymer.



FR-S 1712—Combines a highly aromatic non-volatile processing oil with specially prepared polymer. It effects great savings in the manufacturing of tire treads, motor supports, auto insulators. Its physical properties permit use of additional oil when further cost reduction is desired.



FR-S 141—Shipped in pellet form. A master-batch of 50 parts of high styrene reinforcing resin in 100 parts of FR-S 1006, prepared in latex state. Disperses and mixes well. Useful in production of light-color rubber flooring, shoe soles or any product requiring stiffness and flexibility.



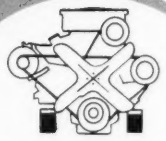
FR-S 146—Its low plasticity makes it adaptable for rapid mixing and high loading procedures. This light-colored, non-staining rubber is excellent for chemically blown sponge products, shoe soles, sporting goods, extruded items and a variety of mechanical goods.

FR-S 154—A master-batch of specially prepared polymers and 37.5 parts of a non-volatile aromatic processing oil for better extrusion control. Exceptional stability, ideal for economical day-to-day production of molded parts, mechanical goods, tire treads and camelback.

FR-S 155—Stabilized for better day-to-day extrusion control. A combination of specially prepared polymers, extended with 37.5 parts of a non-volatile aromatic processing oil. Permits great production savings for automobile windshield gaskets, camelback, motor supports or extruded parts.

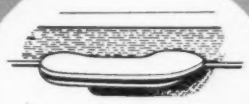
FR-S 158—A master-batch of equal parts of FR-S 1502 and high styrene resin. Prepared in latex state, shipped in easily compounded pellet form; light-colored, stain-free, it is widely used in shoe soles. Imparts high impact strength to all products that can be made of styrene resin.

FR-S 173—A greatly improved polymer with respect to color, cured hardness and processibility. Used in mats, shoe soles and extruded and mechanical goods. It contains a non-staining antioxidant and 25 parts of a light-colored naphthenic oil.



FR-S 178—An economical, light-colored, non-staining rubber, extended with 37.5 parts of naphthenic oil, offers improved color, cured hardness and processing properties particularly desirable in the production of mats, shoe soles and extruded and mechanical goods.

FR-S 179—A base polymer for oil extended rubber; has extremely high viscosity. It is economical; allows compounder to add any amount of oil that best suits his process. Good physical characteristics; excellent for mechanical goods.



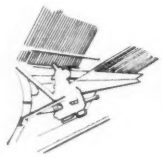
FR-S 181—A new, light-colored, non-staining and non-discoloring rubber, tailored to the manufacture of chemically blown sponge, because mixing time is reduced and peptizing agents are unnecessary. It also finds use in mechanical goods and adhesives.

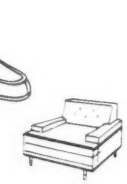
FIRESTONE NOW OFFERS YOU 12 SYNTHETIC FR-S LATICES

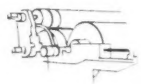
FR-S 2000—The most widely used latex for its economy, stability and high-tensile strength. Used for flexible, durable upholstery, textile and carpet backing. Used with resins to saturate tire cords for greater adhesion. Good for pigment and fiber binding. 42% solids.

FR-S 2001—Outstanding for paper saturation in both beater and web processes. Used to increase flexibility and tear strength. Highly stable; and offers lower molecular weight for better adhesion, still retaining good tensile strength. 42% solids.

FR-S 176—A new low-cost latex for carpet and upholstery backing, saturated papers and adhesives. Highly resistant to ultraviolet light, heat aging and gas fading. Stable to mechanical action and to compounding ingredients. 46% solids.

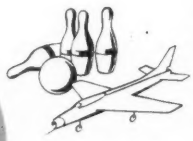






FR-S 2002—For premium back-sizing applications requiring extra light color. Excellent for upholstery and pile carpet; will not discolor conventional dyes. Can be sulphur-vulcanized, provides flexible coatings and films with very good strength. 50% solids.

FR-S 174—A styrene-butadiene resin latex; an excellent stiffening agent for either natural or synthetic latices. For carpet backing and foam it provides increased "hand." Provides better stiffness and tear strength. 50% solids.



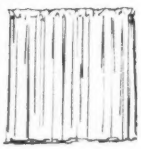
12

FR-S 2003—A high-solids latex specially desirable where light color and low cost are important. Cuts costs by improving foam compound stability. Also used as a resin and plastics additive for better strength and flexibility. 60% solids.

FR-S 151—High-tensile strength, exceptional loading capacity, high modulus with excellent heat and light resistance. Especially useful for carpet back-sizing, upholstery backing, combining compounds and adhesives. 51% solids.

FR-S 2004—A polybutadiene polymer latex which has a particular application in the manufacturing of high-impact plastics. It also is excellent for specialized latex foam uses, where color and freedom from odor are important. 55% solids.

FR-S 150—This new latex is a butadiene-styrene copolymer which is especially desirable for textile back-sizing, adhesives and pigment binding. Offers high molecular weight with good heat and ultraviolet light resistance. 51% solids.



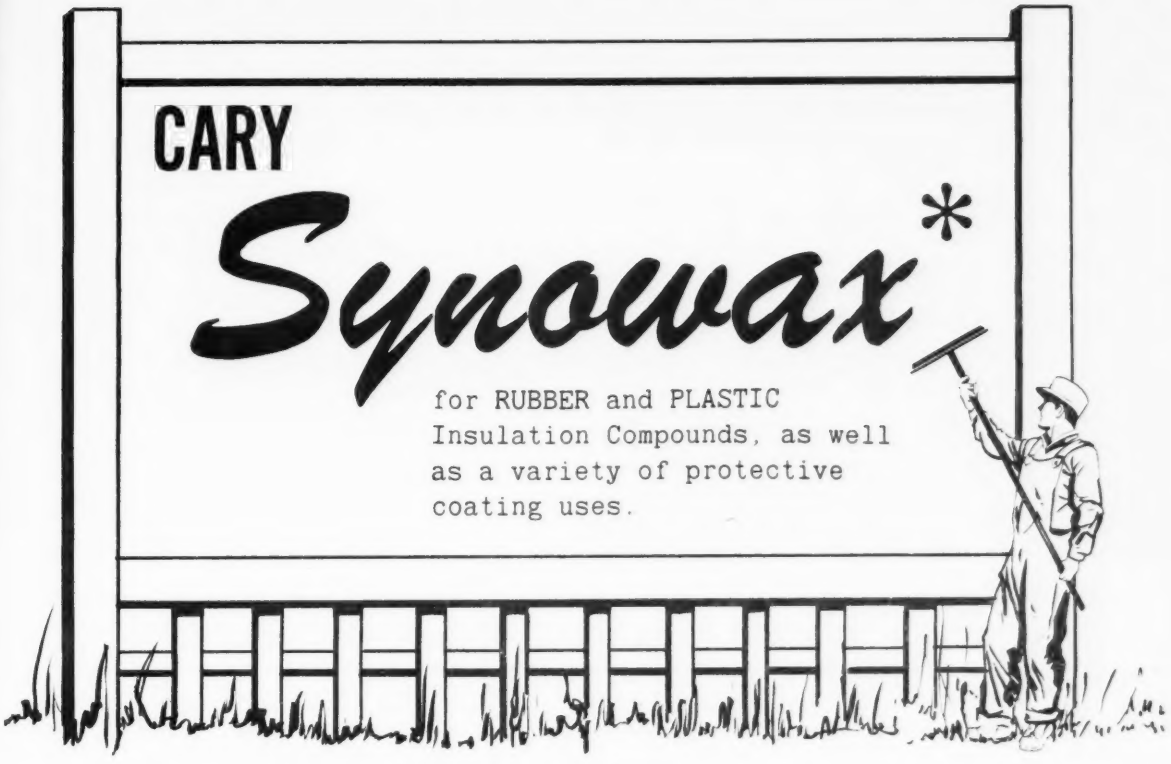
FR-S 110—A new butadiene-styrene latex offering exceptional heat and light stability. Excellent for strong, flexible upholstery and carpet backing resistant to heat, ultraviolet light, aging and gas fading. Also excellent for high-solids adhesives. 51% solids.

FR-S 2105—A "cold" latex combining high-tensile strength with low temperature flexibility. Cuts manufacturing costs of foam products and offers excellent strength, flexibility and pigment loading capacity for backing and sizing of carpets and textiles. 62% solids.

FR-S 2006—A superior chewing gum base, this latex may also be co-coagulated with rubber pigments for dry master-batches with excellent dispersion and good processibility. Increasingly popular for asphalt paving and roofing. 28% solids.

CARY Synowax*

for RUBBER and PLASTIC Insulation Compounds, as well as a variety of protective coating uses.



*Trade name for Cary Chemical's line of high melting point synthetic waxes.

Cary SYNOWAXES — high melting point synthetic waxes have god electrical properties, making them ideal for insulation compounds.

They provide a high softening point and low penetration. Prepared in stainless steel equipment, Synowaxes range in color from light amber to light gray to brown. Acid number is maintained very low, making these waxes almost completely chemically inert.

Melting points up to 400° F. are obtained by highly specialized processes with softening points very close to melting points. This makes them ideal for high temperature applications where flow at temperatures below melting point is not desired.

Additional Features:

- Can be used alone or in combination with other waxes, to enhance their properties.
- Provides permanent lustre finish—as in rubber or vinyl floor coverings.
- High water and moisture resistance.
- Provide excellent lubrication properties.
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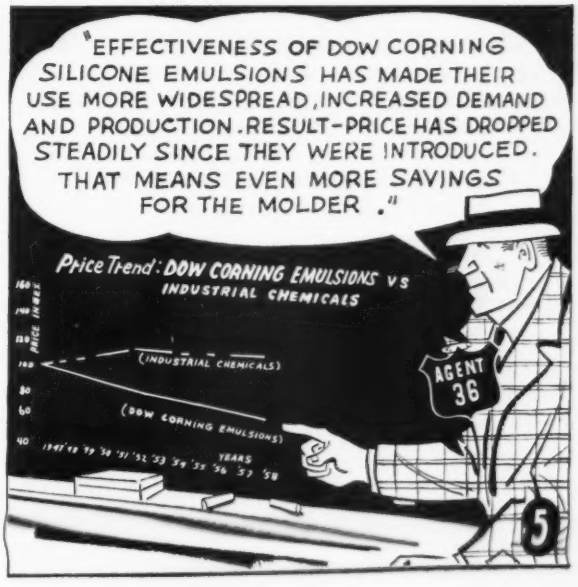
AGENT 36
SILICONE SQUAD
HOW I TRAIN ADVICE SQUADS
FROM THE OFFICIAL FILES OF DOW CORNING
Burt Dirt, Enemy-at-Large
"OUR CHALK-TALC TODAY IS "BEFORE AND AFTER" OR "HOW SILICONES WORK AND PAY."
VISUAL AIDS MOVIE
"THE HOUR OF PARTING
With Miss ZITA ZOOM
Selected Shorts
"QUARTS? TAKE ME TO YOUR LITRE!"
"THEY SAY SILICONES COME FROM QUARTZ."
1
TIPTOE THRU THE TALCUM
JOE STORMIN Foreman
"IN THIS PLANT YOU SEE MESS, WASTE MAINTENANCE, AND... WORST OF ALL.. MOLD DOWNTIME. THAT'S BECAUSE THEY DON'T USE SILICONES FOR MOLD RELEASE."
"IT'S DIRT!"
"IT'S A BOG!"
"IT'S A DIRT BOG!"
2

"HERE'S A PLANT THAT USES SILICONE PARTING AGENTS. NOTE THAT THERE'S NO BUILD-UP IN MOLDS, THEREFORE, VIRTUALLY NO MOLD CLEANING. MOLD DOWNTIME IS CUT TO NIL. SCRAP GOES DOWN. BETTER PRODUCTS RESULT. MONEY IS SAVED! VERY LITTLE TALC IS USED, THE PLANT STAYS CLEANER-SO EVERYONE'S HAPPIER!"
CURSES!
SMACK
DOW CORNING 36
AGENT 36
"THIS PLACE IS PEACHY CLEAN, GENE!"
"SILICONES ARE BREAKING UP THAT MOLD GANG OF GRIME."
3

"YOU'VE SEEN DIRT CLOG A PLANT'S PRODUCTION, AND HOW SILICONE RELEASE AGENTS ELIMINATE THE MESS. BACK IN CLASS, I'LL SHOW YOU MORE FACTS..."
Rubberneck '36'
4


"EFFECTIVENESS OF DOW CORNING SILICONE EMULSIONS HAS MADE THEIR USE MORE WIDESPREAD, INCREASED DEMAND AND PRODUCTION. RESULT-PRICE HAS DROPPED STEADILY SINCE THEY WERE INTRODUCED. THAT MEANS EVEN MORE SAVINGS FOR THE MOLDER."
Price Trend: DOW CORNING EMULSIONS VS INDUSTRIAL CHEMICALS
PRICE INDEX
(INDUSTRIAL CHEMICALS)
(DOW CORNING EMULSIONS)
YEARS
AGENT 36
5

"NOW A WORD FROM A SLICK OPERATOR, SERGEANT SYL-OFF."
"ALWAYS REMEMBER - SYL-OFF IS THE PERFECT RELEASE COATING FOR BAGS OR UNIT CONTAINERS. NOTHING STICKS TO A SYL-OFF PAPER COATING. THAT'S WHY P.A.'S SPECIFY CONTAINERS COATED WITH SYL-OFF FOR CRUDE AND OTHER STICKERS."
AGENT 36
6

first in silicones

Dow Corning CORPORATION
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ATLANTA BOSTON CHICAGO CLEVELAND DALLAS
LOS ANGELES NEW YORK WASHINGTON, D.C.

NEW MATERIALS

Epolene LV Wax

A new, low-cost, low molecular weight polyethylene wax has been added to its Epolene line by Eastman Chemical Products, Inc., subsidiary of Eastman Kodak Co., Kingsport, Tenn. Identified as Epolene LV, the new wax was developed primarily as a modifier for rubber and plastics, as well as an ingredient in polishes. Price is 30¢ per pound in carload quantities.

Some typical physical properties of Epolene LV follow:

Ring and ball softening point	103-104° C
Acid number	<1
Saponification number	<1
Color (liquid) Gardner scale	2
Density	0.925
Flash point	>600° F.
Fire point	600° F.
Bulking factor	30 lbs./cu. ft.
Brookfield viscosity (cps.)	at 120° C., 360
	at 160° C., 145

Niax Triol LK-380

Niax Triol LK-380, a polyether designed primarily for use in rigid polyurethane foams, is now available from Union Carbide Chemicals Co., division of Union Carbide Corp., New York, N. Y. Through the use of this new material it is possible to incorporate the excellent aging characteristics, reduced water sensitivity, and favorable economics of polyethers for rigid foam applications, rather than the hydroxyl terminated polyesters heretofore used.

Niax Triol LK-380 will be useful wherever polyester based rigid foams have found application. These applications include insulation for home refrigerators and freezers, refrigerated transportation equipment, sandwich board construction, non-sinkable boats, life buoys, deck guards, and acoustical tile as well as many other items where a rigid low-density foamed-in-place urethane polymer is required. It is also suggested for investigation in urethane coatings and adhesives.

Some tentative specifications for Niax Triol LK-380 follow:

Volatility, % by weight	0.2 max.
Hydroxyl number, mg. KOH per gm. polyol	361.9–400.1
Acid number, mg. KOH per gm. sample	0.2 max.
Total unsaturation, meq. per gm.	0.04 max.
Water at time of shipment, % by weight	0.10 max.
Ash, % by weight	0.005 max.

A technical bulletin, describing formulation techniques, foam operation, foam formulation, and foam properties, is available from the company.

New MCC-100 SBR Latex

A new latex formulation, MCC-100, is now commercially available from Manufacturers Chemicals Co., Philadelphia, Pa. MCC-100 is a 40% solids styrene-butadiene latex polymer formulation which was developed for and is being used by upholstery fabric manufacturers. The product is applied to fabrics in a standard roller coating operation after which the wet film is dried and cured at temperatures ranging from 250-270° F. for 7-10 minutes. Higher curing temperatures and longer drying times are not detrimental to the coating, but are normally not required, according to the manufacturer.

MCC-100 is formulated so that it has outstanding resistance to heat and light degradation and to gas fading. It forms excellent, continuous films on loosely woven fabrics and does not strike through to the face, it is further claimed. Upholstery fabrics coated with MCC-100 are routinely being dyed in baths made up with copper-containing dyes with negligible discoloration. MCC-100 does not require the addition of an accelerator and is ready to use as received. Its film-forming characteristics allow its use on loosely woven fabrics as well as on carpets and other textiles. Four or five ounces per linear yard produce a tough backing which gives dimensional stability and body to the fabric, states the manufacturer.

Samples, prices, and technical service are available from the company.

SE-53, SE-54 Silicone Gums

Two vinyl-modified silicone gums designed for use in the formulation of Class 500 or extreme low-temperature service silicone rubber compounds have been announced by the silicone products department, General Electric Co., Waterford, N. Y. SE-54 is said to be the only low-shrinkage, extreme low-temperature reactive silicone gum now on the market. SE-53 is a standard shrinkage polymer. Both gums are appropriate for fabricating molded, extruded, and calendered parts for aircraft and other low-temperature applications.

Because these gums are vinyl-modified, ultimate physical properties of the compounds based on them can be obtained with curing cycles shorter than normally required. Other features are the realization of excellent compression set properties without the use of toxic additives, and reduced levels of curing agents.

Some typical physical properties of SE-53 and SE-54 have been reported as follows:

Appearance	clear to hazy	
Specific gravity	0.98	
Consistency	soft, easily worked	
Williams plasticity number	SE-53	120–150 mm
	SE-54	120–170 mm
Solubility		
Soluble in	hydrocarbons, chlorinated hydrocarbons, aromatic solvents	
Insoluble in	water, alcohols, polar solvents	

Technical bulletins giving compounding information and properties of the vulcanizates of these two materials are available from the company.

Shear/Scratch Tester

(*Continued from Page* 828)

an adjustment in load from 0 to 500 grams. An extra calibrated weight is also furnished for attachment to the end of the beam to increase its load capacity to a total of 1,000 grams, the 500-gram load being fixed, and load adjustment obtained with the movable weight.

The scale beam is pivoted on precision ball bearings, the internal bore of which is a slide-fit over the shaft projecting from the mounting. The gage block to which this shaft is fastened can be raised or lowered to correspond with the specimen thickness, thus maintaining the scale beam in level position whether the specimen be a thin plate or up to ¼-inch in thickness.

An instruction bulletin which gives illustrations, shear test procedure, calculation of result, and scratch test procedure and evaluation, is available from the company.

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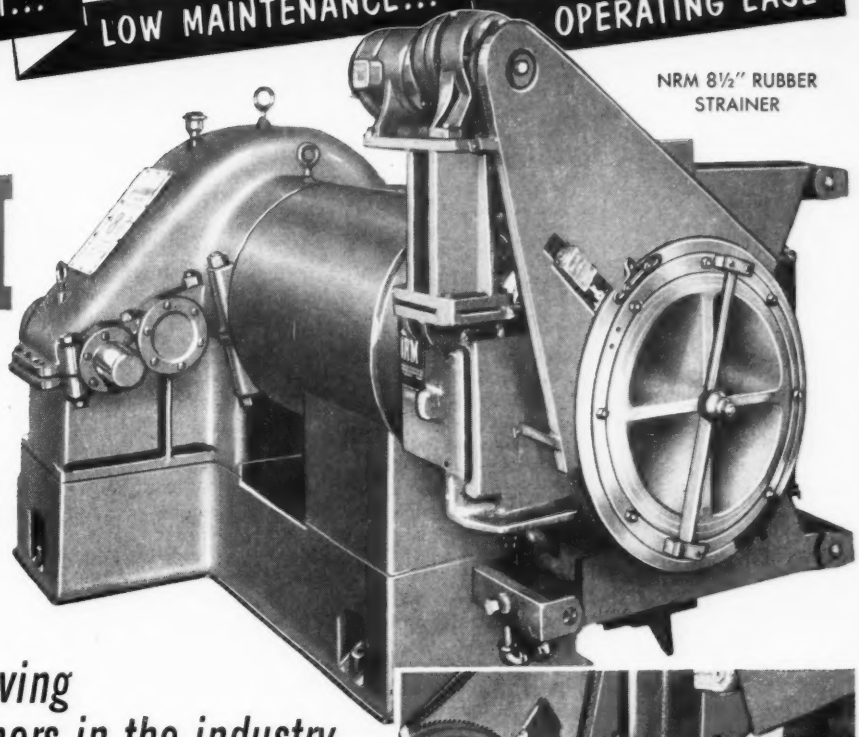
NRM RUBBER STRAINERS



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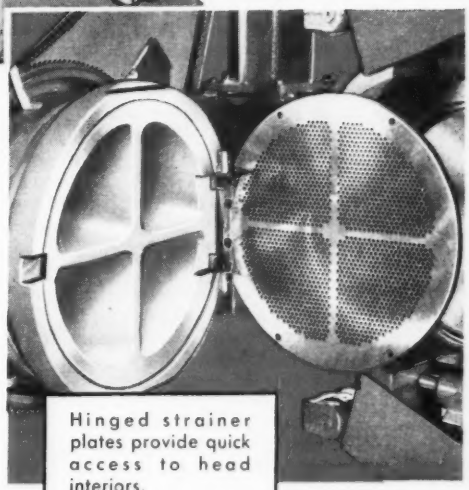
the most time-saving cost-cutting strainers in the industry

AVAILABLE IN 6½", 8½", 10" and 12" SIZES

Long, trouble-free service life is assured by *practical* design and rugged, heavy duty construction throughout. Replaceable cylinder liners are of corrosion and wear resistant Xaloy 306. Transmissions use cut steel, heat treated herringbone gears and heavy duty roller bearings. Feed screw thrust loads are fully absorbed by oversize thrust bearings. All bearing and gear lubrication is automatic.

Important operating features contributing to higher production are: 1), quick-opening air clamps with instant release, saving 5 to ten minutes over manually opened types; 2), strainer plates hinged directly to the head, providing quicker access to plates and cavities for cleaning; and 3), offset and undercut feed boxes, providing maximum and *uniform* stuffing of the cylinder, whether hand or strip fed, and eliminating cylinder "voids."



Hinged strainer plates provide quick access to head interiors.

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TECHNICAL BOOKS

BOOK REVIEWS

"Pilot Plants, Models, and Scale-up Methods in Chemical Engineering." By Robert E. Johnstone and Meredith W. Thring. Cloth. 6 3/8 by 9¼ inches. 316 pages. McGraw-Hill Publishing Co., New York, N. Y. Price $9.50.

This is a book with considerable interest for the chemical engineer charged with plant or process design. Model theory can be used in many ways in the design of pilot plants and models, and this book presents a study of how this theory and empirical extensions of it can be used in the interpretation and scaling up of experimental results.

The first nine chapters in the book deal with theoretical principles. Some of the concepts covered are the principle of similarity, dimensional analysis, differential equations, the regime concept, extrapolation, and boundary effects. The later chapters concern themselves with how these concepts can be adapted to many chemical engineering operations. While the basic tone of the book is analytical and quantitative, there are many descriptions which show how the principles are applied and how the model laws are reduced to "scaled equations," which enable the figures to be scaled up with very little calculation.

Added features of the book are the classification of the literature references under subject headings and the inclusion of recent work of British and other European sources on the application of models to the study of furnaces and combustion systems.

"The Encyclopedia of Chemistry" and **"The Encyclopedia of Chemistry Supplement."** George L. Clark, editor-in-chief; Gessner G. Hawley, managing editor; and William A. Hamor, advisory editor. Encyclopedia 1,037 pages, and supplement 330 pages. Both 10¼ by 7 inches. Reinhold Publishing Corp., New York, N. Y. Price for encyclopedia, $19.50, and for supplement, $10.00.

These two books contain a large number of individual articles on subjects in the chemistry or in some 20 related fields written by an also large number of contributing authors. The basic encyclopedia was published in 1957, with the supplement following in 1958. This supplement will be the only one, according to the authors, and no plans are in existence to put out further books.

The condensed information was prepared by chemists, engineers, and other scientific workers from many varied industrial and academic positions. They cover topics such as atomic power, automatic control, electron tubes, radioactivity, new elements, rubbers, plastics, antibiotics, amino acids, allergy, air pollution, safety, and many, many more similiar items. All branches of chemistry as well as chemical engineering and related fields are covered.

These two volumes, and the supplement follows along in regular order and brings the first volume up to date, contain much valuable information for persons or plants manufacturing almost any type of product. As a quick reference book on chemistry, it can hardly be excelled.

As the authors state in their preface, they sought to achieve a reference book in which a vast range of subject matter is correctly weighed, usefully organized, and concisely presented by experts in such a way as to be accurate and highly informative to anyone having a bowing acquaintance with chemistry. It would appear that they have been at least moderately successful in this endeavor.

NEW PUBLICATIONS

"Catalin—Chemicals, Resins, Plastics." Catalin Corp. of America, New York, N. Y. 12 pages. This illustrated booklet describes the plants, facilities, and major products of the company, providing information on many applications of the products. Antioxidants, bacteriostats, and other chemicals are discussed, as are both thermosetting and thermoplastic industrial resins. Data on various formulations and grades of styrene, nylon, and polyethylene resins are included.

"Architectural Portfolio." B. F. Goodrich Flooring Products Co., Watertown, Mass. This special architectural portfolio includes a new architect's manual, general catalog reprinted from "Sweet's Architectural File," facts on Koroseal vinyl asbestos floor tile, and a folder featuring molded rubber stair treads. The manual is a complete document for the specification of resilient tile flooring. Included is a floor tile selection chart which shows the approximate costs, the applicable Federal Specifications, wearing qualities, characteristics, properties, and other information. Special charts show recommended adhesives, static load data, acoustical properties, and light reflectivity values for various types of BFG floor tile. Specification information is also given for flooring accessories such as molded rubber cove base, vinyl cove base, and molded rubber stair treads. The portfolio and the manual are available from the company without charge to architects, chief draftsmen, designers, specification writers, interior designers and engineers.

"Silco-Flex for Motor and Generator Stator Coils." Bulletin 05B8341A. Allis-Chalmers Mfg. Co., Milwaukee, Wis. 6 pages. The Silco-Flex impervious insulation system for motor and generator stator coils, described in this brochure, has as its basis a semi-organic silicone elastomer characterized by extreme chemical stability and retention of original properties under the most adverse conditions. Properties described include resistance to aging, abrasion, chemicals, corona, fire, moisture, oil, solvents, fungus, carbon black, and arcing. Mechanical properties of the insulating system are said to remain flexible and resilient over a —60 to 250° C. temperature range, even after long heat aging.

"Nettco Side-Drive Agitators." New England Tank & Tower Co., Everett, Mass. 6 pages. This technical bulletin on Nettco side-drive agitators provides cross-section, engineering drawings on agitators with stuffing box or mechanical seal. It shows details on both types with or without unique Nettco shutoff feature for servicing under full tank pressure. Design features, dimensional illustrations and data are given on belt driven, gear driven, and direct motor driven side-drive models. Exclusive features and design advantages are itemized. Applications are listed, and some actual installations are illustrated.

"Proceedings of 13th Conference of the Reinforced Plastics Division, The Society of the Plastics Industry, Inc." Two Volumes. The Society of the Plastics Industry, Inc., New York, N. Y. These volumes contain full technical details on the most significant developments in reinforced plastics in materials, processing, performance, and end-uses, for a price of $7.00 plus postage. The first volume is a 627-page preprint book containing texts and illustrations of the 72 talks presented at the reinforced plastics technical and management conference. The second volume, on proceedings, comprises a full report on questions and answers engendered at the 16 separate conference sessions. Topics covered are building, boats, tooling, premix materials, preforming and filament winding, high-temperature performance, and new materials.

"Motor Starting Center." Bulletin 58-C. Richardson Scale Co., Clifton, N. J. 4 pages. This technical bulletin discusses the advantages of centralizing motor starters in control panels, citing the savings in initial costs, wiring, engineering time, and reduced maintenance costs that result from mounting the starter centers in control panels at the time the panel is constructed. Six photographs of motor starter centers mounted in the firm's control panels are included.

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With Viton A and 1.5 phr Diak No. 1 Maglite Y gives superior results for low compression set . . . For non-supported articles in hot air service . . . For parts exposed to di-2-ethylhexyl sebacate . . . For general mechanical goods where best balance of properties are required for heat, hydraulic fluid, lubricant and fuel resistance. Maglites D or M are recommended for fabric coated or supported sheet for hot air applications. They show little or no modulus increase, only slight increase in hardness and no loss in elongation during exposure to hot air. Loss of tensile strength should not be critical since they are supported. Both also give outstanding service in silicate-ester hydraulic fluid (MLO 8200) whether supported or not. Manufactured by: Merck & Company, Inc. Sold by The C. P. Hall Co. For more complete details write for our new Bulletin #5821A entitled "Magnesia Cures in Viton® A."

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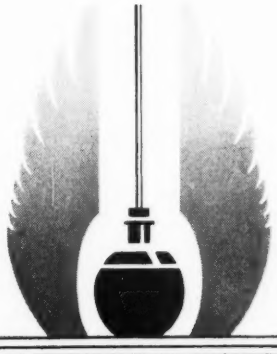

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Technical Books

"Huber Water Fractionated Clays for the Rubber Industry." J. M. Huber Corp., New York, N. Y. 12 pages. The physical, chemical, and rubber properties of three major grades of Huber water fractionated clays (Polyfil C, Polyfil X, and Polyfil F) are given. Tensile and tear resistance curves are shown which demonstrate the changes resulting from increasing these clay loadings in three polymers, neoprene, SBR, and smoked sheet. Recipes, processing data, and graphs are included.

"Adhesives, Coatings, Sealers." Minnesota Mining & Mfg. Co., St. Paul, Minn. 12 pages. This two-color illustrated catalog describes design concepts, typical applications, and general characteristics of the company's adhesives, coatings, and sealers. Considered are oil-soluble elastomeric adhesives which include natural, reclaimed, and synthetic rubber based adhesives; oil-resistant elastomeric adhesives which include neoprene and nitrile rubber based adhesives with or without synthetic resin bases; and high-strength structural adhesives which include epoxy resin adhesives and adhesives made from combinations of synthetic elastomers and resins. Also covered are protective industrial coatings based on reclaimed rubber, natural resins, oils, or synthetic resins; and sealers in the form of liquids, semi-liquids, and solids.

"Disogrin." Disogrin Industries, Inc., Mount Vernon, New York. 24 pages. Two-color, heavily illustrated with graphs, charts, and photographs, this brochure describes the physical, chemical, electrical, thermal and other technical data on Disogrin, the polyurethane elastomer. In addition, a chart compares this material's properties with those of other materials. A list of the more commonly used grades, ranging from soft to hard, including the other properties of each grade, is given. Design tips on this material are discussed in detail.

Publications of The British Rubber Producers' Research Association, Welwyn Garden City, Herts, England:

No. 269. **"The Influence of Rubber on the Brittleness and Viscosity of Bituminous Materials."** P. Mason, E. N. Thrower, and L. M. Smith. 9 pages. The brittleness and the resistance to deformation of rubber/bitumens and of sand asphalts made with rubber/bitumens have been investigated and compared with results obtained with similar materials not containing rubber. The results showed that the incorporation of rubber produces a material which displays, under the test conditions used, a marked increase in resistance to deformation, simultaneously with a reduced brittleness at low temperatures.

No. 270. **"Oxidation of Organic Sulfides. Part IX.** The Reaction of Ozone with Organic Sulfur Compounds." D. Barnard. 9 pages. Organic monosulfides, disulfides, and tetrasulfides are oxidized by ozone. Reaction mechanisms are suggested based on ozone-absorption measurements, the effect of ozone on related sulfur compounds, and rate data derived from competitive ozonolyses.

No. 271. **"The Reaction of Sulfinyl Chlorides with Zinc; The Spontaneous Decomposition of Aryl Thiolsulfinates."** D. Barnard. 4 pages. In the first study it was found that aryl and alkyl sulfinyl chlorides react readily with zinc, to give good yields of the corresponding thiolsulfonates instead of the expected disulfoxides. The second paper reports on the occasional disproportionation of thiolsulfinates into thiolsulfonates and disulfides:

$$2R{\cdot}SO{\cdot}S{\cdot}R \rightarrow R{\cdot}SO_2{\cdot}S{\cdot}R + R{\cdot}S{\cdot}S{\cdot}R.$$

"SP Rubber." Technical Bulletin No. 2. W. P. Fletcher and H. C. Baker. 19 pages. This bulletin describes the newly developed SP natural rubber which consists of an intimate mixture of cross-linked and unmodified rubber. It is produced on Malayan estates by mixing vulcanized and normal *Hevea* latex; the blend is coagulated and worked up into sheet or crepe rubber by conventional methods. SP-RSS will sell at a premium of 1¾ cents over regular RSS. The new superior processing rubber is said to be particularly good for extrusion work and will be used mostly for hose, wire, etc. It is on the market in small quantities and has been sold in 5-10-ton lots to United States manufacturers.

"Services for You." Foster D. Snell, Inc., New York, N. Y. 14 pages. This brochure covers such topics as product research and development, product improvement, and application, comparative testing, biology and toxicity, chemical engineering, market research, product and process control, and other areas where Snell renders service. This booklet is designed to serve as a guide for manufacturers, distributors, importers and exporters, investment firms, individuals, governmental agencies, advertising companies, and trade organizations.

"Looking Backward and Forward." Aldan Rubber Co., Philadelphia, Pa. 28 pages. This booklet, a special fiftieth anniversary report, is kept on a humorous, informative level with just the briefest of items noted on each page for advertising the growth, services, and products of Aldan. The back cover, however, lists Aldan's fabricating items including athletic field covers, industrial protective clothing, inflatable boats, luggage, hunting jackets, convertible car tops, wading pools, foul-weather gear, protective clothing for the Armed Forces, plus many other products for consumer, industrial, and military applications.

"GK Glomax Extender Pigments." Georgia Kaolin Co., Elizabeth, N. J. 18 pages. This brochure summarizes a study of the company's Glomax series of calcined clays in emulsion paint systems. Included are the effects of calcined clays on the properties of acrylic, styrene-butadiene, polyvinyl acetate, homopolymer and copolymer paint systems. Suggested starting formulations are given for each of the major types of emulsion paint systems.

"Exide-Ironclad Batteries." Exide Industrial Division, The Electric Storage Battery Co., Philadelphia, Pa. 8 pages. This technical bulletin describes a new line of storage batteries which boosts the work capacity of present-day electrical industrial trucks by as much as 44%. A section details how each battery can be used interchangeably in more than one size of truck. It also shows how it is possible to design shorter and more maneuverable trucks through the use of smaller, yet equally powerful batteries.

Publication of the Office of Technical Services, United States Department of Commerce, Washington, D. C.:

"Study, Standardization of Specifications for Insulated Wire." R. E. Barbiere, P. M. Costanzi, and B. J. Compton. RCA Service Co. for WADC, U. S. Air Force. Order PB 131805. $3.50. 244 pages. This standardization study of specifications for multi-conductor cables used by the Armed Services was designed to eliminate duplications and minor variations in cable materials, constructions, and test procedures and to incorporate the results in a single specification that would supersede all the specifications under study. The number of cable types was reduced; standard requirements for cable components were established; and standard test procedures were developed. The publication is described as being easy to use and understand.

"Fluorine-Containing Polyethers: Part II." O. R. Pierce, D. D. Smith, and R. M. Murch, Dow Corning Corp., Midland, Mich., for WADC, U. S. Air Force. Order PB 131227. February, 1956. 42 pages. $1.25. Attempts were made to synthesize fluorine-containing polymers of the polyether type for possible use as thermally stable elastomers in applications such as sealants, rubbers, coatings, and adhesives. A rather extensive study of the hypohalogenation of fluorine-containing olefins indicated that the reaction generally fails. In the area of polymerization, the use of free radical initiators was studied, but no satisfactory rubber was obtained. Polymers prepared were quite solvent, however, and might find possible applications.

"Proceedings of the President's Conference on Technical and Distribution Research for the Benefit of Small Business." Order PB 1311460. $2.50. 297 pages. The proceedings constitute a small businessman's guide to the research assistance he may receive from other small businesses, large businesses, federal and state agencies, colleges and universities, trade associations, private research and development organizations, trade publications, professional societies, technical libraries, and local business organizations. The book also details how small businesses have used this assistance to their advantage and makes recommendations for future utilization of research information.

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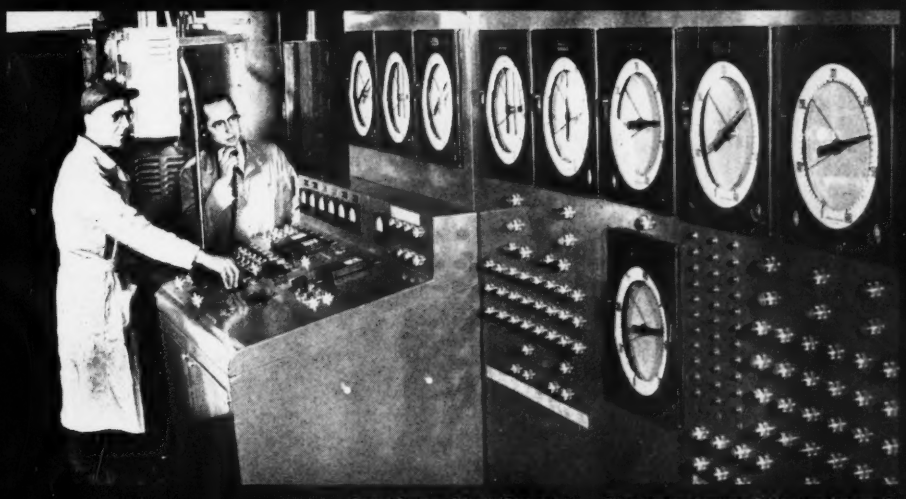

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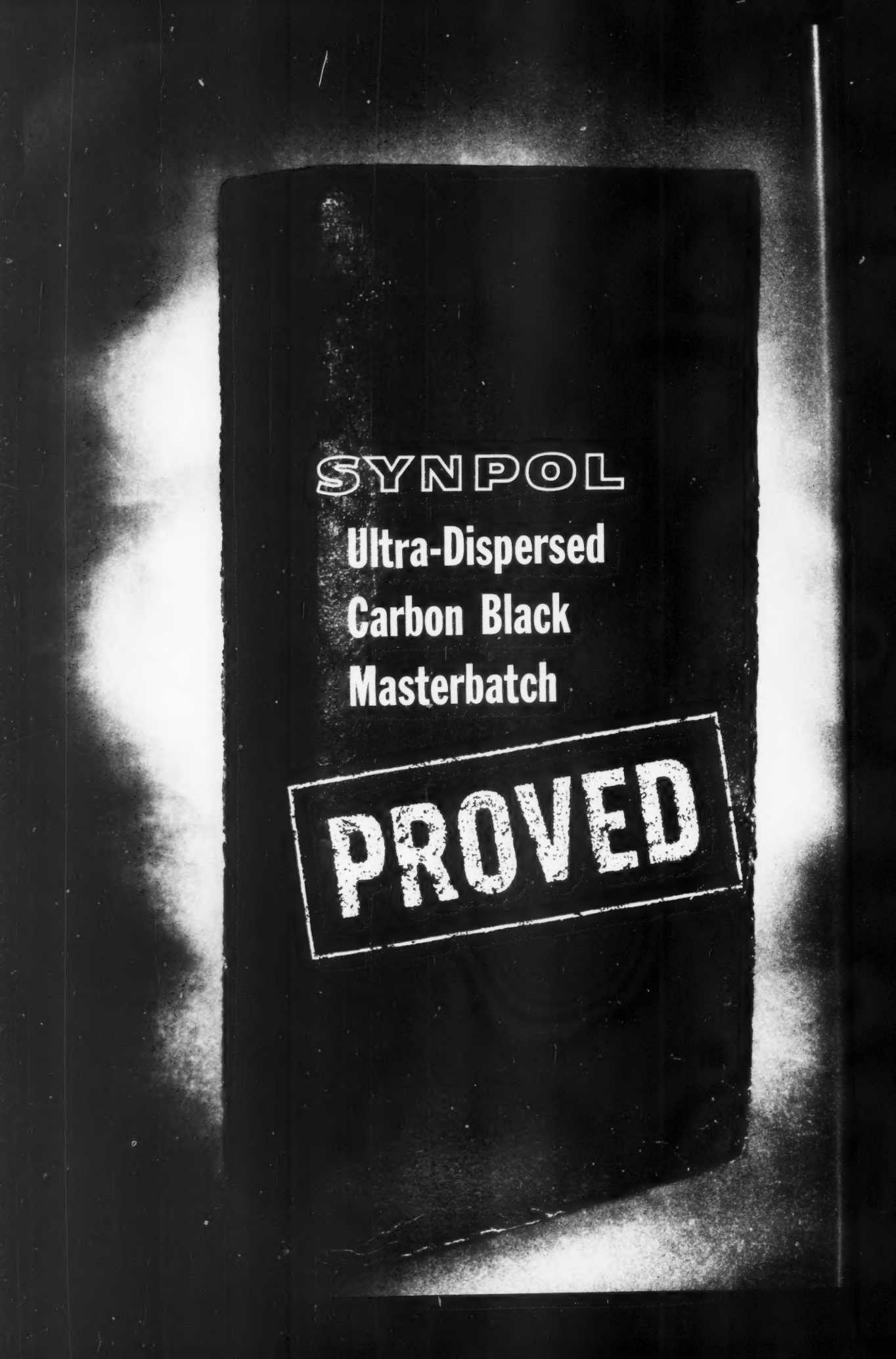
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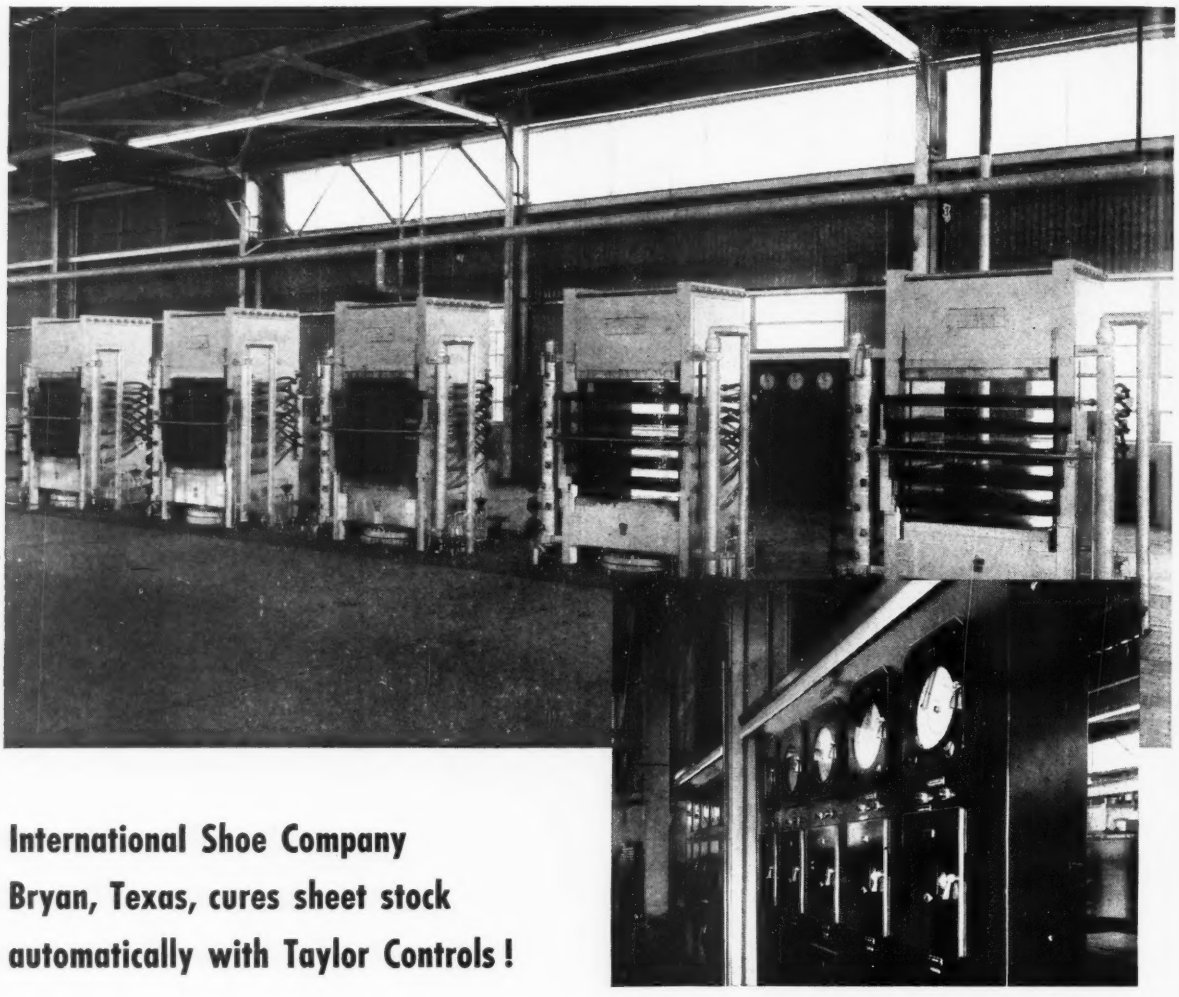

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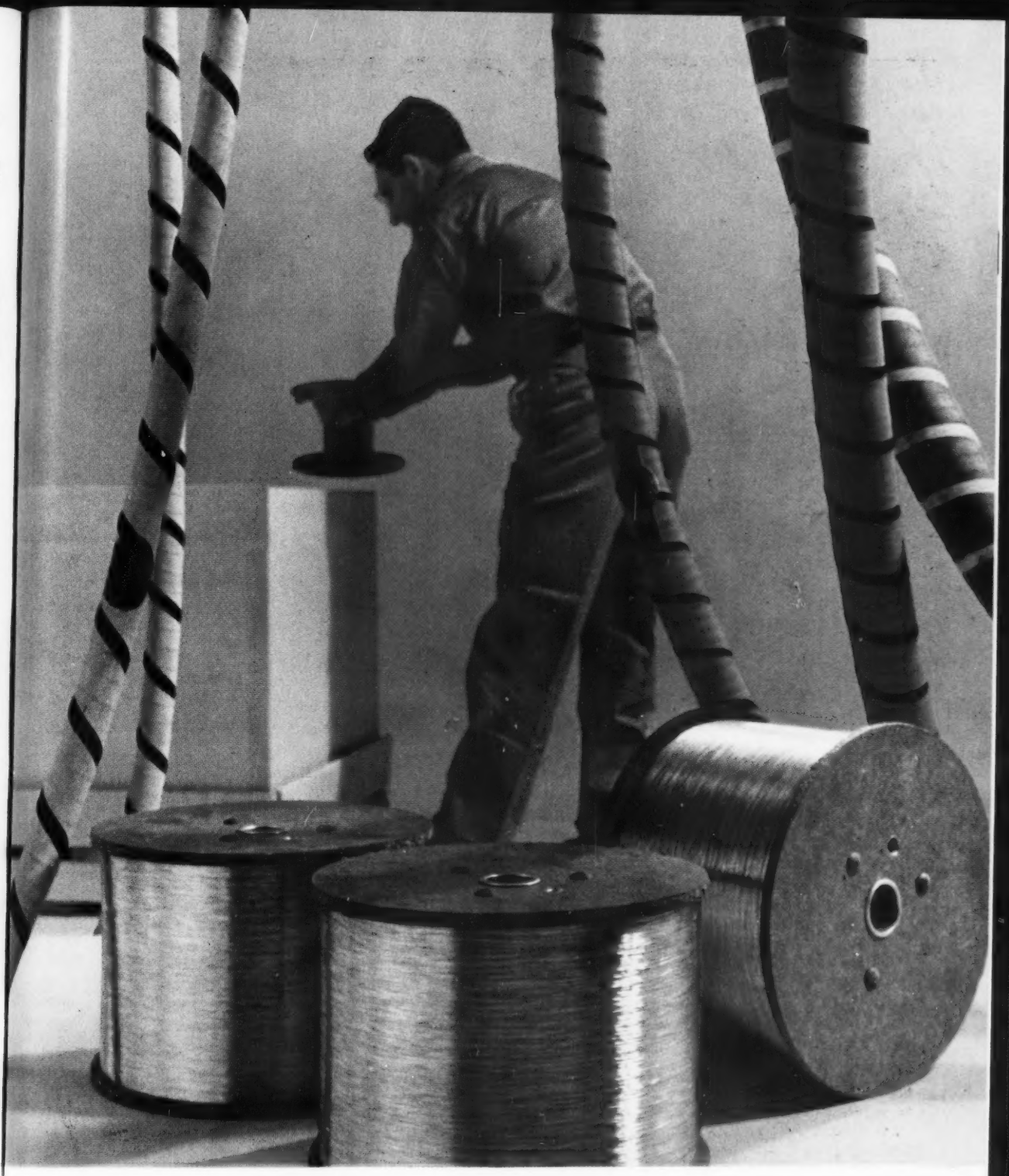

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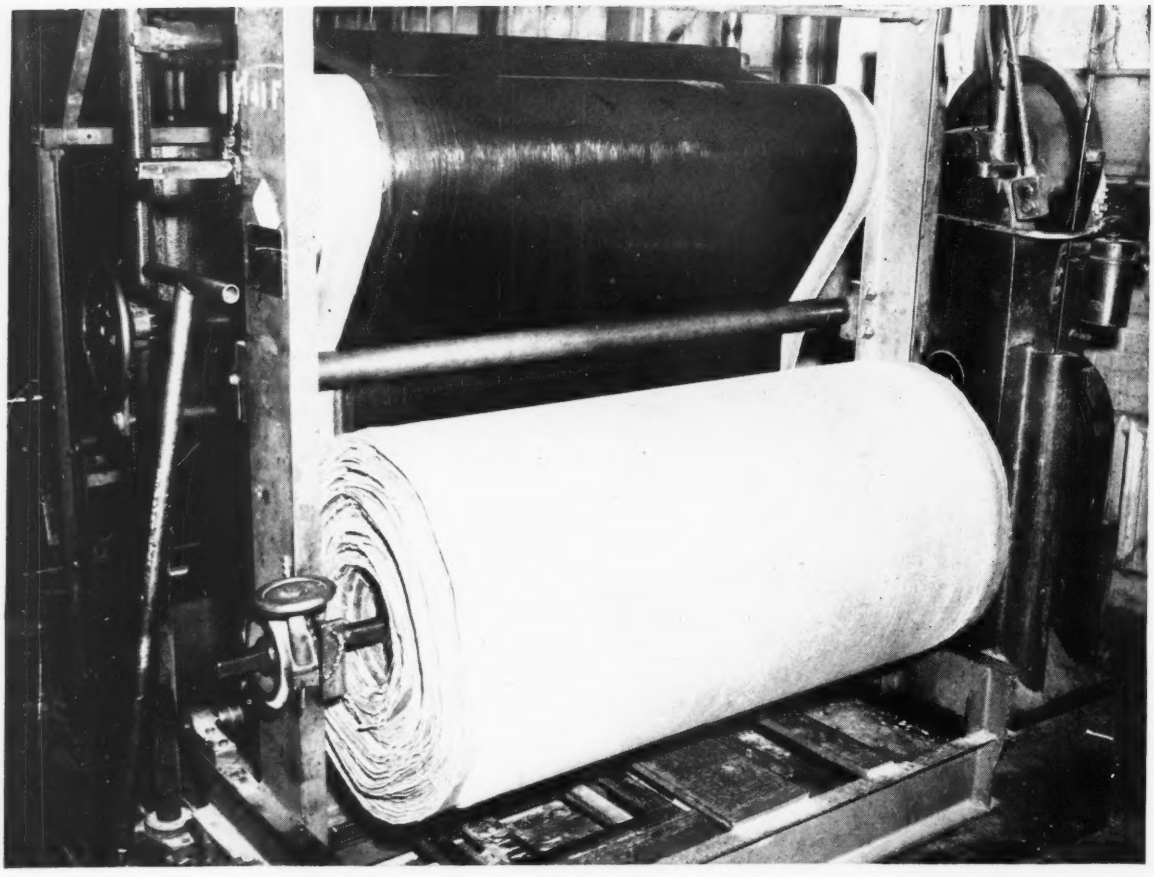

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NEWS of the RUBBER WORLD

Government Synthetic Rubber Program of war and postwar years criticized before Senate Judiciary Subcommittee on Patents, Trade-marks and Copyrights for lack of significant innovations. Removal of profit incentive, competition, and existence of wartime technology patent pool cited as reasons for limited progress.

The United States Government has agreed to provide the know-how and part of the funds for a $41-million natural rubber plantation of 80,000 acres in Guatemala. The first $5-million loan will be repaid in 12 years. An annual output of 40,000 long tons is expected.

Rubber Manufacturers Association establishes "Committee on Public Affairs" to keep tabs on legislative issues of direct interest to the industry and American business as a whole. Top management of large and smaller companies to be represented on this committee.

Wage talks between Big Four companies and United Rubber Workers union have begun with the union prepared to make substantial demands and the companies depending on the strength of public opinion to hold down inflationary wage settlements.

Past, present, and future of SBR indicate growth of production of oil-extended SBR to 50% of total cold, non-black rubber in 1958 should continue, and renewed interest in black masterbatches may make these the fastest-growing category of SBR production, according to panelists at the Chicago Rubber Group, January 30 meeting.

Firestone Tire & Rubber Co. is building a 30,000-ton plant for the production of Diene (cis-polybutadiene) or Coral (cis-polyisoprene) rubbers. Dayton Tire & Rubber Co. is doubling its tire manufacturing capacity this year. U. S. Rubber's Naugatuck Chemical Division is building new laboratory for solid fuel research. Goodyear Tire & Rubber Co. has announced the development of a modified SBR "luxury" rubber for tires, named Plioprene.

Shell's synthetic rubber

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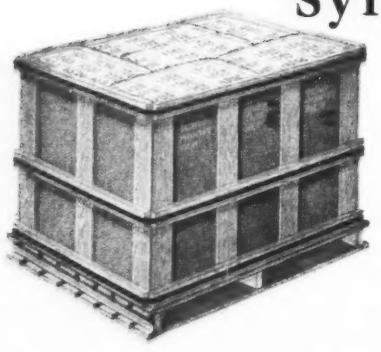

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Shell offers you the Flotainer* package, a strong, lightweight, steel-strapped wooden container that holds 42 film-wrapped bales. Completely new in principle, "Flotainer" controls cold flow in uncured synthetic rubber; prevents contamination; simplifies and speeds handling; lets you store 20 tons of rubber on less than 100 sq. ft. of floor space. For more information on this packaging innovation, write Shell for an illustrated bulletin.

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This polymer is the **ALL-PURPOSE** cold rubber. Light-colored, clear, its balance of physical properties makes it suitable for a variety of uses—from white sidewalls to chemically blown sponge.

S-1703

When you want **ECONOMY** with **COLD RUBBER** properties and processing advantages for use in light-colored goods, consider this **OIL MASTERBATCH** of 25 parts of nonstaining oil in 100 parts of polymer.

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You can reduce mixing time by using this oil black masterbatch in making **TREAD RUBBER** and **MOLDED** or **EXTRUDED GOODS.** It contains 10 parts of oil and 60 parts HAF black to each 100 parts of S-1500 type polymer.

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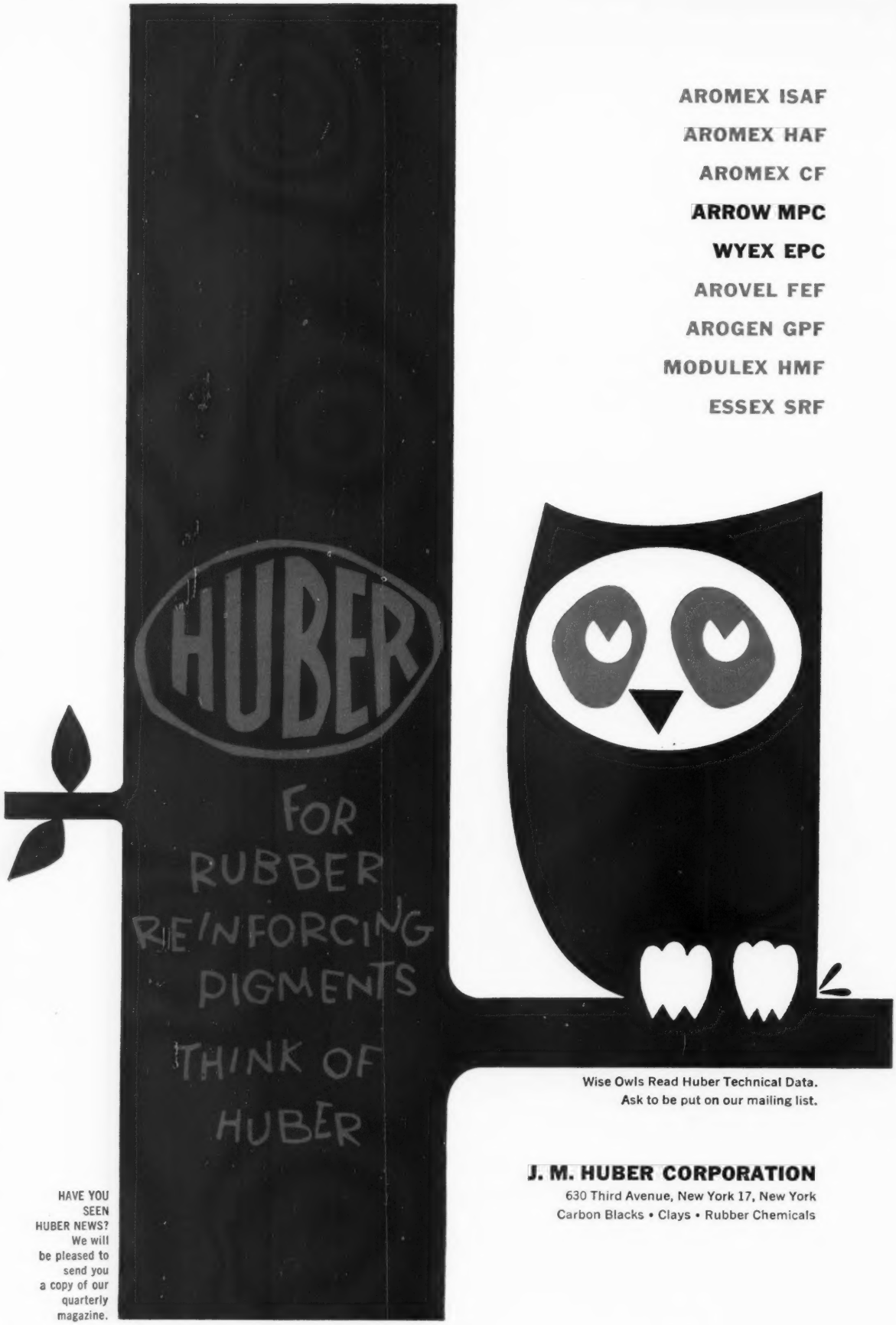

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RUBBER WORLD
EDITORIAL

Another Appeal to SBR Producers On Commercial-Experimental Rubbers

IN AN editorial entitled, "An Attempt To Help SBR Producers Help Themselves," in our December, 1958, issue we called attention to a situation which has developed in the field of marketing styrene-butadiene rubbers (SBRs) that could result in a disservice not only to the producers themselves, but to their customers. This situation involves the system of numbering experimental SBRs as described in the "Tentative Recommended Practice for Description of Types of Styrene-Butadiene Rubbers," Designation D 1419-58T, of the American Society for Testing Materials, which was established with the approval of the SBR producers in June, 1956. These ASTM numbers which run from 3000 to 9499 and are assigned in groups of 500 to each of the 11 American SBR producers, were established for designating experimental rubbers that do not conform to the regular types numbered from 1000 through 1800.

When this ASTM system was set up, it was assumed that when any SBR carrying an experimental number achieved sufficient demand to be considered commercial rather than experimental, the producer would ask for a number in the regular commercial 1000 through 1800 series. Unfortunately, most producers feel that having advertised and publicized certain of these so-called experimental SBRs until they have achieved the demand to justify them as commercial SBRs, they should continue with the experimental number. There is no system of publicizing the description or prices of these "experimental which have become commercial SBRs," however, and it was felt that RUBBER WORLD could render a service if it could obtain these descriptions and prices and publish this information for the benefit of producers and consumers alike.

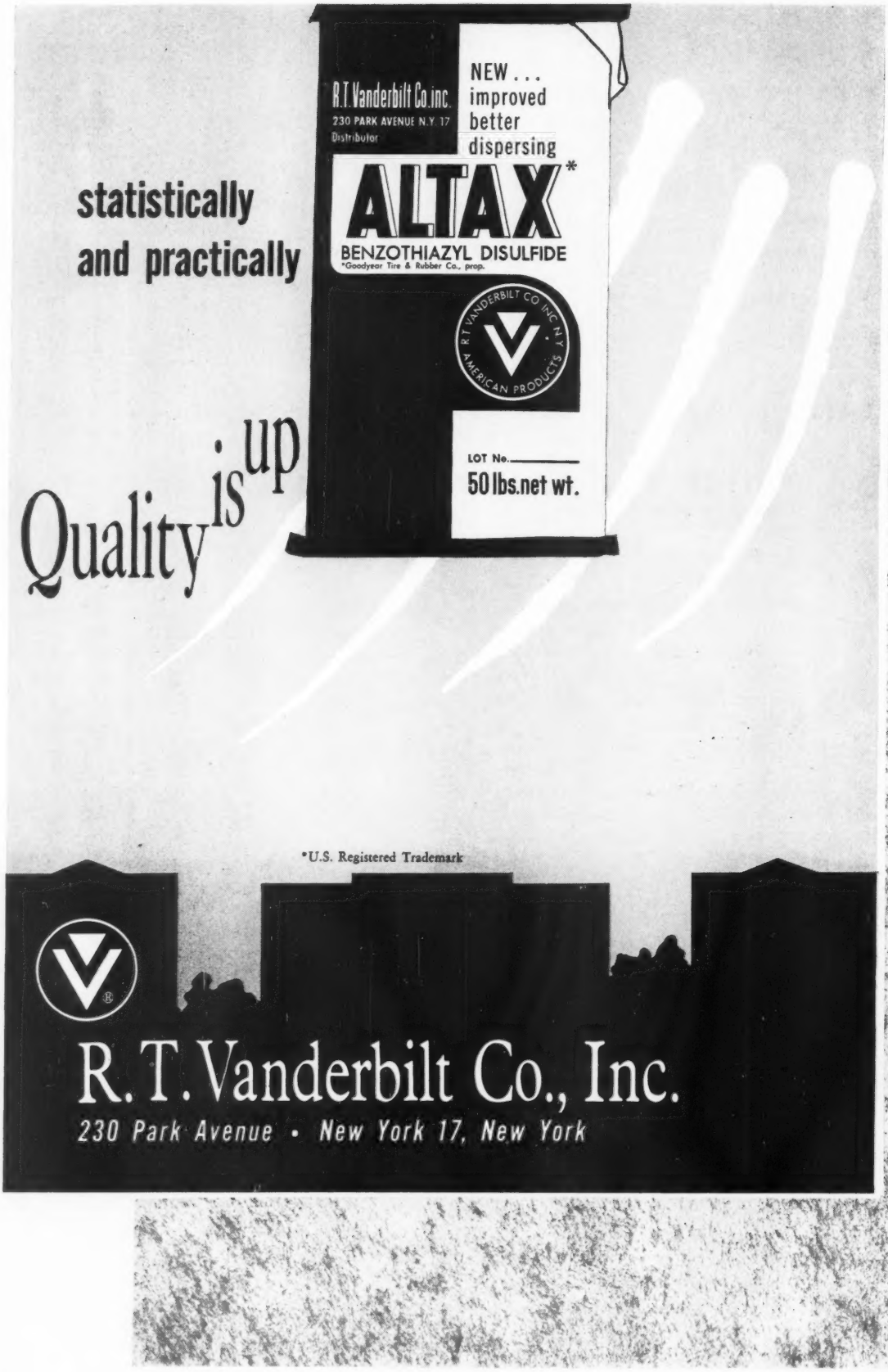
Copies of the December editorial and a covering letter were mailed to all 11 American SBR producers in December, with a request for such information. Replies were received from five producers in which they either forwarded or agreed to forward the desired information on their new commercial SBRs with experimental numbers. Three other producers replied that they had no experimental numbered SBRs that they consider commercial, and no reply was received from three producers.

Meanwhile the ASTM committee responsible for setting up the SBR numbering system in 1956 has appointed a special task group to study this entire situation and make recommendations for its improvement. It would seem obvious that there should not be any commercial SBRs whether they carry a standard number or an experimental number, about which there is no information on compositions and uses and prices in the public press.

RUBBER WORLD will therefore go ahead with its plan to publish prices and other information on these commercial SBRs carrying experimental numbers to the extent that such information is made available by the producers. *We urge all SBR producers to review their lists and provide us with maximum information. It should be to their advantage!*

R. G. Seaman

EDITOR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RUBBER WORLD

Trends in Rubber Research[1]

By A. V. TOBOLSKY
Princeton University, Princeton, N. J.

IN THIS discussion I will attempt to foresee the trends in rubber research for the next several years. These forecasts are not based on "inside information," but on an effort to apply basic principles of polymer science to the requirements for synthethic rubbers. Since knowledge of the basic principles of polymer science and an ability to apply these logically to industrial requirements are presumably widespread among workers in these fields, the forecasts may have some measure of validity.

A research scientist has the constant compulsion to create new knowledge which in some measure undermines the basic principles which make the prediction of the moment reasonable. As a member of this breed, it is difficult for me to write an article or present a talk without including something new. The material under "Network Destruction at Elevated Temperatures" and "Cross-Linking in Natural Rubber" in this paper presents some new facts of today which I hope will spice this discussion of tomorrow.

[1]Presented before the Fifth Joint Army-Navy-Air Force Conference on Elastomers, Dayton, O., Oct. 15-17, 1958.

[2]Numbers in parentheses refer to bibliography items at the end of this article.

Requirements for Synthetic Rubbers

The requirements for synthetic rubbers appear to me to fall into the following categories (a non-exclusive list).

1. A GENERAL-PURPOSE RUBBER. Such a rubber, mainly for use in passenger tires, must have a balanced combination of adequate physical properties, great availability, and low cost. At present this need is filled by styrene-butadiene rubber (SBR). In the future we have as potential competitors synthetic natural rubber (1)[2], *cis*-polybutadiene (2), improved butyl rubber (3), and ethylene-propylene copolymers (4).

2. A PREMIUM RUBBER. This rubber must provide maximum safety and maximum life for passenger and truck tires. Such a rubber might develop from the somewhat costly polyurethane polymers (5). A low-cost rubber of premium quality might just possibly arise from olefin polymers such as properly selected blends of ethylene-propylene copolymers of special structure.

3. SWELL-RESISTANT RUBBERS. Generally, these are rubbers with high solubility parameters, but whose chain flexibility nevertheless provides a sufficiently low

The Author

A. V. Tobolsky, Higgins associate professor of chemistry at Princeton University, received his A.B. from Columbia University in 1940 and his Ph.D. in physics and chemistry from Princeton in 1944.

He has been a member of the faculty at Princeton in the Department of Chemistry since 1944, and also has been a consultant to various companies in the chemical industry.

Dr. Tobolsky is a member of the American Chemical Society, the Society of Rheology, and Sigma Xi. In 1957 he received the Bingham Medal of the Society of Rheology. He is also a member of the board of editors of the *American Scientist*.

Trends in Rubber Research

Trends in rubber research not based on "inside information," but on an effort to apply basic principles of polymer science to requirements for synthetic rubbers are forecast here.

Requirements for synthetic rubbers on this basis appear to fall into the following major categories: (1) a general-purpose rubber with a balanced combination of physical properties, ample availability and low cost, which at present is filled by SBR, but with several other promising candidates available; (2) a premium rubber, which would provide maximum safety and life for passenger and truck tires, perhaps available from the somewhat costly urethane polymers or possibly from lower-cost blends of ethylene-proplyene copolymers of special structure; (3) swell resistant rubbers; generally these are rubbers with high solubility parameters, but whose chain flexibility provides sufficiently low glass transition temperatures; (4) low-temperature rubbers; these are rubbers with low glass transition temperatures; (5) high-temperature rubbers; these rubbers include fluororubbers, silicone, polyester, acrylate, and adduct rubbers; (6) castable rubbers which include polysulfides, polyurethanes, low molecular weight polydienes, etc.

Rubbers may be divided into the following classes; (a) those which are wholly amorphous under all conditions, even when stretched; (b) those which are amorphous under most conditions in the unstretched state, but which crystallize upon stretching; (c) those which are slightly crystalline in the temperature interval of their use even in the unstretched condition.

Work with natural rubber, SBR, butyl, a polyester rubber, and adduct rubber employing the stress relaxation technique emphasizes the tremendous difference in resistance to network cleavage at 130° C.

Using the continuous and intermittent stress relaxation technique and comparing sulfur cured and radiation cured natural rubber vulcanizates, it is shown that the cross-linking reaction in natural rubber is mainly a post-cure effect. On the other hand, oxidative cross-linkage is found in polybutadiene vulcanizates, even those cured by radiation.

glass transition temperature T_g.[3] Among these are nitrile, neoprene, polysulfide, adduct-rubber (7), Vyram (8), etc.

4. Low-Temperature Rubbers. These are rubbers with very low T_g, such as polybutadiene for all-around use and silicone rubber (9) for special use.

5. High Temperature Rubbers. These rubbers include such polymers as Viton A (10), Kel-F rubber (11), silicone rubber (9). For prolonged use at moderately high temperatures are saturated rubbers such as adduct rubber, Vyram, polyester rubbers, polyethylacrylate rubbers (8). We could obtain even higher temperatures with fluoropolymers (12) than at present by sacrificing rubberiness at room temperature.

6. Castable Rubbers. These include polysulfides, polyurethanes, low molecular weight polydienes (13), etc.

Amorphous and Crystalline Character Of Rubbers

Rubbers divide into the following classes: (a) those which are wholly amorphous under all conditions, even when stretched; (b) those which are amorphous under most conditions in the unstretched state, but which crystallize upon stretching; (c) those which are very slightly crystalline in the temperature interval of their use even in the unstretched condition.

Rubbers of class (a) include SBR, nitrile rubber, emulsion polybutadiene, butyl, etc. In class (b) we have natural rubber, synthetic *cis*-polyisoprene, *cis*-polybutadiene, neoprene, polyurethane, etc. In class (c) we include rubbery plastics such as plasticized polyvinyl chloride, partially N-methyl substituted polyamides produced on a research basis only by Du Pont, lightly chlorosulfonated polyethylene, etc.

For obtaining the best in the way of tensile strength, elongation, tear strength, and abrasion resistance we might expect in the future an extensive cultivation and expansion of classes (b) and (c). For example, new block copolymers might be synthesized, one block being composed of linear polyethylene or isotactic polypropylene and the other block being a random copolymer of ethylene and propylene. Such a polymer would belong to classes (b) or (c), would have high melting crystalline regions, and amorphous regions of low T_g. Blends of different varieties of ethylene-propylene copolymers may also prove interesting.

In class (a), the wholly amorphous polymers, we might expect a great deal of research pointed toward improved aging and improved high-temperature properties. Furthermore, much research should be done on

[3]The glass transition temperature (for rubbers) is roughly the temperature at which the 10-second modulus is 500 times the room temperature modulus of the rubber. More accurately, for any polymer, the value of T_g is obtained from specific volume temperature curves as the temperature at which a fairly abrupt change of slope is detected (6).

TABLE 1. T_g VALUES FOR SELECTED POLYMERS

Polymer	T_g °C.
Silicone rubber	−123
Polybutadiene (emulsion 50° C.)	− 85
Butyl	− 70
Natural rubber	− 72
Poly (butyl acrylate)	− 56
Poly (ethyl acrylate)	− 22
Poly (methyl methacrylate)	105
Styrene/Butadiene Copolymers	
0/100	− 85
25—75	− 57
70—70	18
90—10	68
100—0	100

TABLE 2. SOLUBILITY PARAMETER FOR SEVERAL POLYMERS

Polymer	Solubility Parameter
Teflon	6.2
Silicone rubber	7.3
Butyl rubber	7.7–8.5
Natural rubber	7.9–8.4
Polybutadiene	8.4–8.6
SBR	8.1–8.55
Neoprene	9.2
Nitrile (NBR)	9.4
Polymethylmethacrylate	9.5
Nylon 66	13.6
Polyacrylonitrile	15.4

improving the filler-rubber bond in all these polymers since the physical properties depend so markedly on this bonding.

Law of Corresponding States for Mechanical Behavior

All amorphous polymers obey in a qualitative way a reduced equation of state for viscoelastic properties and probably even for properties such as tensile, elongation, tear, etc. That is to say, if all of these mechanical properties for amorphous polymers (of the same chain length or cross-link density) were measured as a function of temperature T and the results were plotted against T/T_g or $T\text{-}T_g$, *all* amorphous polymers would show a qualitatively similar behavior. To state this in the most concrete terms, copolymers of styrene and butadiene on the one hand and octyl acrylate and methyl methacrylate, on the other, would show similar mechanical properties at copolymer compositions that gave the same T_g. See Table 1 for T_g values of selected polymers.

It is therefore not surprising that the all-purpose rubbers such as natural rubber, SBR, and butyl have T_g values that do not differ too greatly. In designing an all-purpose styrene-butadiene copolymer, it was found that higher styrene contents gave better gum strength, but poorer hysteresis and poorer low-temperature properties. The balance of properties that SBR possesses is perhaps to be expected because of the close similarity of its T_g value to that of natural rubber.

Yet this principle of corresponding states is only an approximation. For example, at room temperature butyl polymer has less resilience and natural rubber more resilience than might be expected from their T_g values. (I am leaving out such considerations as network defects etc.) The principle of corresponding states for mechanical behavior is useful in setting boundaries on what might possibly be expected from new amorphous polymers.

Strength Properties

Gum strengths of amorphous rubbery polymers which do not crystallize on stretching are notably poor. Only those polymers like natural rubber, neoprene, *cis*-polybutadiene, and the polyurethanes, all of which crystallize on stretching, have good gum tensile and tear strength. For wholly amorphous polymers the use of reinforcing fillers is absolutely necessary to achieve respectable strengths.

The utility of many synthetic rubbers will be greatly expanded when improvement of the rubber-filler bond is achieved. The way has already been pointed in recent butyl rubber developments There is every reason to think that the same can be accomplished for every class of synthetic rubber which presently suffers from inadequate strength. Improvement of the polymer-filler bond should also help resilience.

I wonder if the superb abrasion resistance of polyurethanes as compared to that of natural rubber, is not due to the high melting temperature of its crystallites. Perhaps the strength of polymer filler bond as a function of temperature ought to be examined in connnection with the abrasion of wholly amorphous rubbers.

Molecular Parameters Affecting T_g

It is widely recognized that polymers with high solubility parameters have high T_g values. It is less recognized that chain flexibility is also an important factor—the higher the flexibility the lower the T_g. The solubility parameter is a measure of the intermolecular cohesive forces and is readily obtained from swelling measurements. Table 2 gives solubility parameters for some polymers. A discussion of solubility parameter is given in reference (6).

We have recently determined the T_g of amorphous sulphur as being about —21° C. This is a relatively low value because of its chain flexibility and in spite of its very high solubility parameter.

Chain flexibility is directly correlated with low barriers to internal rotation around the bonds along the polymer chain.

The following remarks on fluorine containing polymers emphasize the point.

Glass Transition Temperatures of Fluorine Containing Polymers

An amorphous copolymer containing 69 weight %

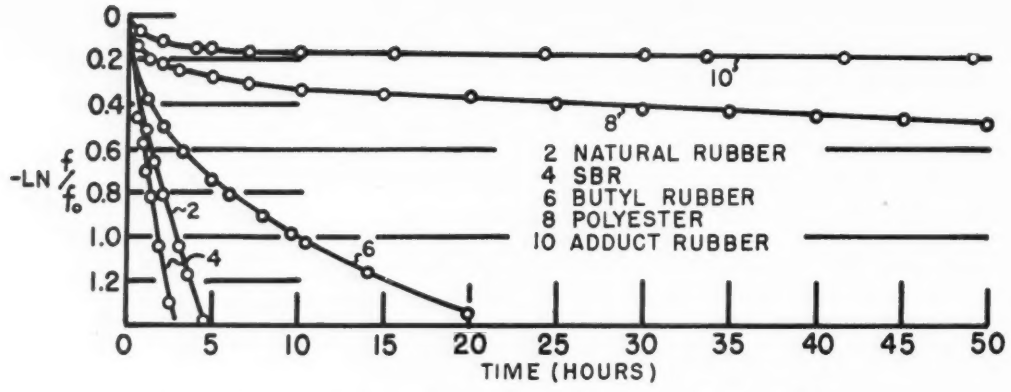

Fig. 1. Stress relaxation of rubbers cured without sulfur at 130° C.

vinylidene fluoride and 31 weight % perfluropropylene (Viton A) was found in this laboratory to have a T_g of—25° C. Since the T_g of polyvinylidenefluoride is known to be —39° (14), the T_g value of polyperfluoropropylene can be estimated, using the equation of Fox (15).

$$1/T_g = W_1/T_{g,1} + W_2/T_{g,2}$$

where W_1 and W_2 are weight fractions of the copolymer constituents and $T_{g,1}$ and $T_{g,2}$ are the glass transition temperatures of the pure homopolymers in their (sometimes hypothetical) amorphous condition.

T_g for polyperfluoropylene is calculated to be about 11° C. from the above equation and the facts presented in the first paragraph. Since the solubility parameter of perfluorinated polymers is very low, this rather high value of T_g must be due to chain stiffness (high barriers to internal rotation).

This brings up an interesting question concerning the glass transition of polytetrafluorethylene (Teflon).[4] It has been reported to be as low as —112° C. by many workers (16). I have very grave doubts that the mechanical properties methods (vibration damping, modulus-temperature) or volume-temperature measurements give valid values of T_g when applied to highly crystalline polymers. It is hard for me to see why Teflon should have so much lower a T_g value than polyperfluoropropylene. Application to Teflon of Beaman's rule (17).

$$0.5T_m < T_g < 0.67T_m$$

predicts a value of T_g in excess of room temperature, and I think that this will be found to be the case, (T_m is the melting temperature, defined only for crystalline polymers.)

An important practical question is at stake here: If T_g for Teflon is in fact —112° C., amorphous copolymers of tetrafluorethylene and perfluorethylene or similar monomers should make rubbers that are flexible down to quite low temperatures. I doubt that this would be found true. In order to obtain good low-temperature properties in the field of fluorine-containing elastomers it is necessary to have flexibility in the chain backbone, such as would be conferred by

$$CH_2{=}CF_2,\ CH_2{=}CH(CF_3),\ CH_2{=}CF(CF_3),$$

and similar monomers.

Network Destruction at Elevated Temperatures

The best rubbers for very high temperature use (greater than 200° C.) are at present the silicone rubbers (e.g., Silastic) and flurocarbon rubbers (e.g., Viton A and Kel-F rubber). There is need of rubbers, however, which will be serviceable for long periods of time at temperatures from 100-150° C., and which will not be so expensive as silicones and fluorocarbons.

Very much can be done in this field by proper choice of chain structure.

Stress decay at constant extension at high temperatures provides a fine tool for measuring resistance of a rubber network to chemical cleavage. At any time the quantity f_t/f_o, where f_o is the initial stress, and f_t the stress at time t, measures the fraction of network chains that have not been cleaved until time t. In a recent study A. Mercurio and the author (18) studied stress decay at constant extension in vulcanizates of natural rubber, SBR, butyl, a polyester rubber of the Paraplex[5] type, and adduct rubber. All were vulcanized without sulfur (radiation cures for natural rubber and SBR, paraquinone dioxime plus lead peroxide for butyl, benzoyl peroxide for the polyester rubber, and dicumyl peroxide for adduct rubber). The tremendous difference in resistance to network chain cleavage at 130° C. as between these rubbers is clearly seen in Figure 1. The behavior of adduct rubber is outstanding.

Special acrylic rubbers such as Vyram, not studied in this series, also show excellent resistance to cleavage at this temperature.

Cross-Linking in Natural Rubber

The methods of continuous and intermittent stress relaxation have been employed to isolate the cross-linking and scission reactions in rubber vulcanization (14).

By comparing these two measurements for sulfur-accelerator cured natural rubber vulcanizates *versus* radiation cured natural rubber vulcanizates, we have demonstrated that the cross-linking reaction in natural rubber is mainly a postcure effect, as shown in the

[4]E. I. du Pont de Nemours & Co., Inc., Wilmington 98, Del.
[5]Rohm & Haas Co., Philadelphia 5, Pa.

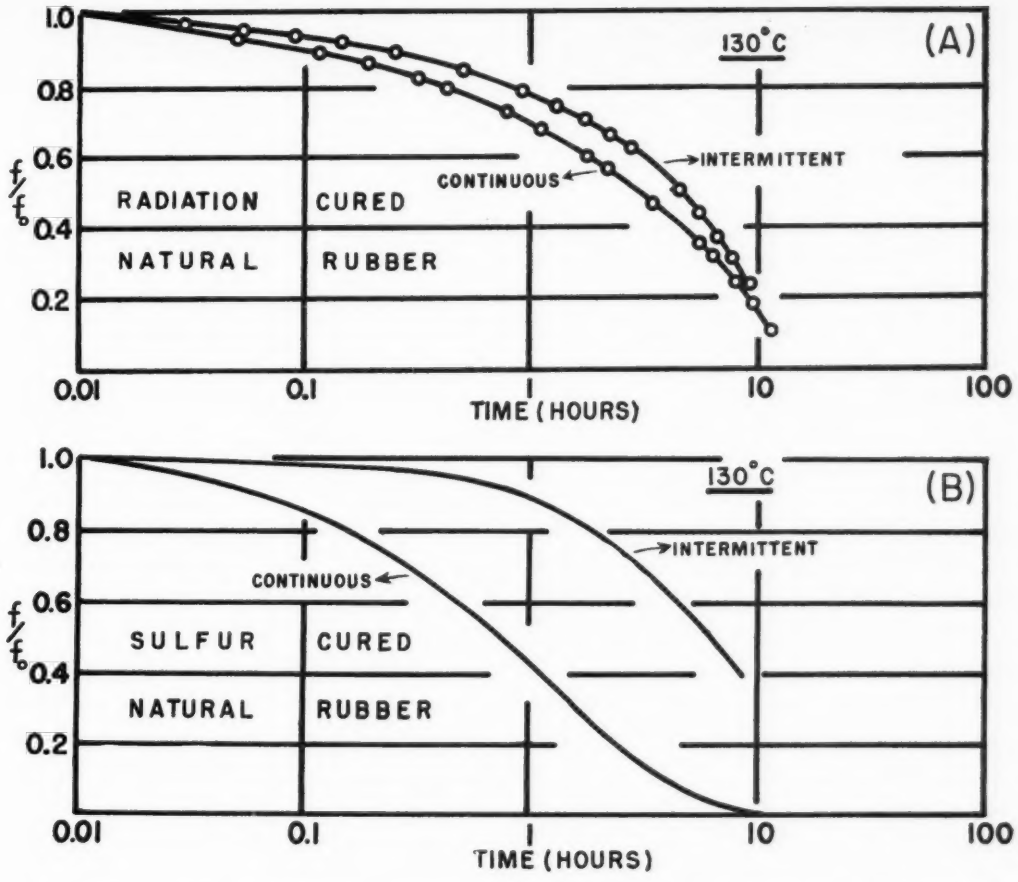

Fig. 2. Stress relaxation both continuous and intermittent of radiation cured and sulfur cured NR

Figure 2 (19). On the other hand, there is unmistakable oxidative cross-linkage in polybutadiene vulcanizates, even those cured by radiation. The hardening of butadiene-based rubbers vulcanized by chemical means is in part cross-linking by molecular oxygen and in part postcure. This is demonstrated in Figure 3 (20), by comparison of intermittent and continuous stress relaxation.

Summary and Conclusions

Requirements for synthetic rubbers, both now and in the future, appear to be for a general-purpose rubber, such as styrene-butadiene rubber; a premium rubber, such as polyurethane or lower cost blends of ethylene-propylene copolymers of special structure; swell-resistant rubbers with high solubility parameters, but whose chain flexibility provides sufficiently low glass transition temperatures; low-temperature rubbers with low glass transition temperatures; high-temperature rubbers, such as fluororubbers, silicone, polyester, acrylate, and adduct rubbers; and castable rubbers, such as polysulfides, polyurethanes, low molecular weight polydienes, etc.

Rubbers may be classified according to those which are wholly amorphous under all conditions, even when stretched; those which are amorphous under most conditions in the unstretched state, but which crystallize on stretching; and those which are slightly crystalline in the temperature interval of their use even in the unstretched condition.

Work with natural rubber, SBR, butyl, a polyester rubber, and adduct rubber employing the stress relaxation technique emphasizes the tremendous difference in resistance to network cleavage between these several rubbers at 130° C.

Using the continuous and intermittent stress relaxation technique and comparing sulfur cured and radiation cured natural rubber vulcanizates, it is shown that the cross-linking reaction in natural rubber is mainly a post-cure effect. On the other hand, oxidative cross-linkage is found in polybutadiene vulcanizates, even those cured by radiation.

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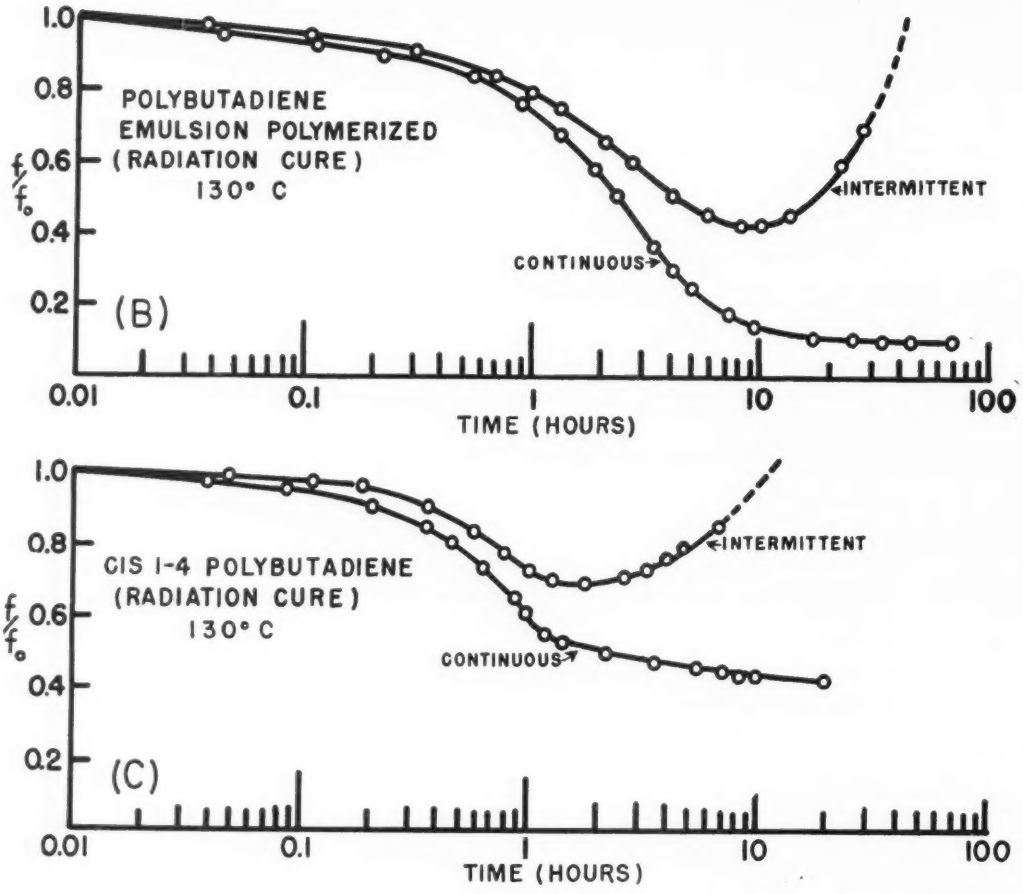

Fig. 3. Stress relaxation both continuous and intermittent of radiation cured emulsion polymerized polybutadiene and *cis* 1-4 polybutadiene

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(Continued on page 868)

Wing-Stay 100 as an Antioxidant And Antiozonant—I[1]

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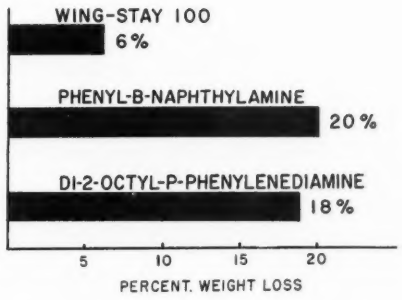

Fig. 1. Antioxidant volatility after six hours at 150° C.

DIPHENYL-P-PHENYLENEDIAMINE is a widely used material in the rubber industry. A survey of the literature shows that diphenyl-p-phenylenediamine may act four ways in rubber: namely, as an antioxidant, as an antiflex cracking agent, as a metal deactivator (1),[2] and as an antiozonant (2-5). Its synergistic effect (6) with other antioxidants is the basis of many commercial antioxidant mixtures.

Wing-Stay 100 Physical Properties

One of the difficulties of using diphenyl-p-phenylenediamine as a compounding ingredient is its limited solubility in rubber. Furthermore, it has a high melting point so that finely ground material is necessary for a good dispersion.

Wing-Stay 100 was designed to overcome these difficulties. It consists of a mixture of diaryl-p-phenylenediamines with a melting point between 93 and 105° C. The new antioxidant is approximately three times as soluble in rubber as diphenyl-p-phenylenediamine so that up to 1.0 part may be used in natural rubber and 3.0 to 4.0 parts in SBR vulcanizates before bloom occurs. This increased solubility is of particular value for antiozonant properties since it is now well established that antiozonants become much more effective when used at the two- to four-part level than in lesser amounts.

Wing-Stay 100, in contrast to most antiozonants, has a very low volatility. Volatility was measured by heating a 1.0-gram sample on a two-inch watch glass at 150° C. in a circulating air oven. Samples were rotated on a turntable. Weight losses were measured at the end of each hour. Data in Figure 1 show the comparative volatilities of Wing-Stay 100, phenyl-beta-naphthylamine (PBNA), and di-2-octyl-p-phenylenediamine, Throughout this paper di-2-octyl-p-phenylenediamine is representative of a group of dialkyl-p-phenylenediamines widely used as antiozonants. Wing-Stay 100 is only one-third as volatile as the other two materials which suggests its use in articles which must survive high temperatures.

Because of its low volatility, rubber articles containing Wing-Stay 100 have little tendency to stain objects they contact. To demonstrate this point, Plioflex 1500 black vulcanizates containing 1.25 parts PBNA, two and four parts of Wing-Stay 100 and one, two, and four parts of di-2-octyl-p-phenylenediamine were placed in contact with white cardboard at room temperature in the dark for 10 days. Figure 2 shows the results obtained. It can be seen that di-2-octyl-p-phenylenediamine stains much more than Wing-Stay 100.

TABLE 1. TYPICAL TREAD STOCK TEST FORMULATIONS USED

	LTP SBR	SBR, Oil-Extended	Natural Rubber	O.E. SBR for Ozone Studies
Plioflex (SBR) 1500 or 1006	100	—	—	—
Plioflex (SBR) 1712	—	137.50	—	137.50
Natural rubber	—	—	100	—
HAF black	50	68.75	45	68.75
Stearic acid	2.0	2.0	3.0	1.0
Rubber process oil	5.0	5.0	—	—
Paraffin wax, mp. 145° F.	—	—	—	1.5
Zinc oxide	3.0	3.0	3.0	3.0
Pine tar	—	—	3.0	—
Sulfur	1.75	1.75	2.75	2.0
Benzothiazyl disulfide	1.0	1.0	—	1.0
Diphenylguanidine	0.2	0.2	—	0.3
2-(Morpholinothio)-benzothiazole	—	—	0.4	—
n-Nitrosodiphenyl-amine	—	—	0.5	—
Antioxidant or antiozonant	variable	variable	variable	variable

[1]Presented before the Division of Rubber Chemistry, ACS, Chicago, Ill., Sept. 11, 1958. Contribution #234 from the Goodyear research laboratory.

[2]Numbers in parentheses refer to Bibliography items at end of this article.

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He is active in the Akron Men's Garden Club as well as in the rubber and polymer divisions, American Chemical Society. Other memberships include Phi Lambda Upsilon and Sigma Xi.

R. B. Spacht, research chemist at Goodyear, was awarded his B.S. in education by Kent State University in 1929. After teaching at Mantua High School from 1929 to 1932 he returned to Ohio State University to obtain his M.A. in chemistry in 1934 and his Ph.D. in chemistry two years later.

Dr. Spacht has included a professorship in chemistry at Kent State and work as a chemist at National Aluminum Cylinder Head Co., Cleveland, O., in his experience before joining the Goodyear research department in 1946. In addition to his duties as research chemist at Goodyear he continues to instruct at Kent State parttime.

Dr. Spacht is a member of ACS, The Kent Research Group, Sigma Xi, Sigma Tau Gamma, and Phi Lambda Upsilon. He is currently a member of the Kent, O., school board.

W. S. Hollingshead, a chemist at Goodyear, received his B.A. from Youngstown College in 1950 and has done further work at Hiram College and Akron University.

Mr. Hollingshead has been with Goodyear since 1951 following a short term of employment as a chemist with the Koppers Co., Youngstown, O.

Wing-Stay 100 Chemical Properties

Chemically, the substituted p-phenylenediamines are subject to direct attack by oxygen. Wing-Stay 100, PBNA, and di-2-octyl-p-phenylenediamine were tested for oxygen absorption at 90° C. In order to obtain a very thin film of the material for maximum exposure to the oxygen, finely divided material was placed in the bottom of a number of beakers to a thickness of only 0.03-inch. These beakers were then stacked in the oxygen absorption tube and tested as previously described by Shelton(7-9). Measurements were made as for rubber samples. Results are shown in Figure 3. These curves show that di-2-octyl-p-phenylenediamine absorbs 12% oxygen in 17 hours while Wing-Stay 100 absorbs only 1%. PBNA is relatively inert toward direct attack by oxygen.

Wing-Stay 100 has another advantage over presently used antiozonants. It shows little tendency to cause scorch in rubber stocks. Scorch measurements were made on SBR 1500 (Plioflex) and SBR 1712 (Plioflex) black compounds. Formulation for Plioflex 1500 and for Plioflex 1712 is shown in Table 1. Results of the Mooney scorch are shown in Figure 4 for Plioflex 1500 and for Plioflex 1712. These figures give the times required for a five-point rise in Mooney viscosity. It can readily be seen that Wing-Stay 100 is superior to di-2-octyl-p-phenylenediamine in scorch resistance. In both polymers there is no change of the scorch values for stocks containing Wing-Stay 100 as the concentration of the latter is increased; while for di-2-octyl-p-phenylenediamine there is a noticeable decrease in scorch times as the concentration of the antiozonant is increased. In general, the scorch values of di-2-

Wing-Stay 100 as an Antioxidant and Antiozonant

A material with fourfold benefits of diphenyl-p-phenylenediamine, but with considerably greater solubility in rubber is described, with its properties and some test results. Wing-Stay 100 is a mixed diaryl-p-phenylenediamine which also acts as an antioxidant, antiozonant, antiflex cracking agent, and metal deactivator in rubber. Wing-Stay 100 is reported to be three times as soluble in rubber as the diphenyl-p-phenylenediamine and with a much lower volatility and oxidation rate, which means that its slower migration to the surface provides lasting protection.

This new material is shown to cause less staining than present commercial disubstituted-p-phenylenediamine antiozonants owing to its lower volatility, and an added feature is the very little effect Wing-Stay 100 has on the rate of cure.

This study presents data on the use of Wing-Stay 100 in natural rubber tread stocks, with high-temperature flex properties showing up very well. This new antioxidant is proposed as an excellent stabilizer for SBR polymers acting both as an antioxidant and as a metal deactivator. When used in amounts of two to three phr in vulcanizates, the antioxidant gives very good weathering and ozone resistance, as shown by trials in SBR tread stocks.

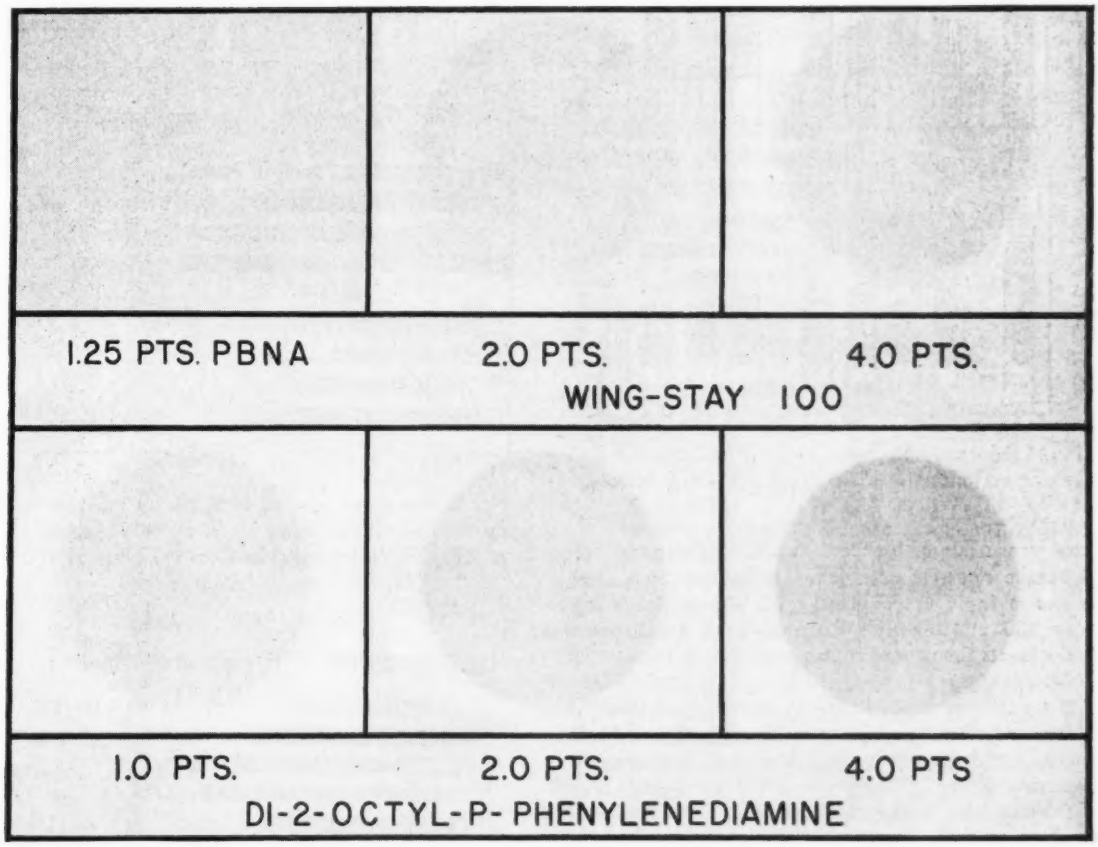

Fig. 2. Staining by various antioxidants in SBR (Plioflex) 1500 after 10 days at room temperature

octyl-p-phenylenediamine are from one-half to two thirds those of Wing-Stay 100.

Wing-Stay 100 in Natural Rubber

Wing-Stay 100 is an excellent antioxidant and antiflex cracking agent for natural rubber. It may be used in natural rubber tread stocks in amounts up to 1.0 part. Greater amounts may cause blooming. Tests in natural rubber were made on the formulation shown in Table 1. Cure was for 70 minutes at 275° F. All

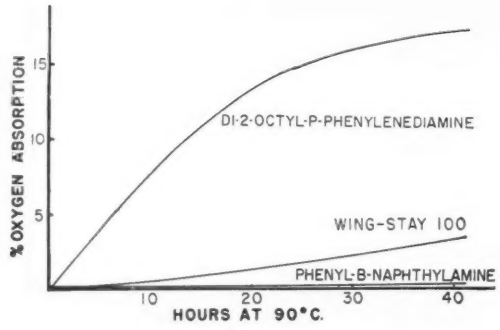

Fig. 3. Oxygen absorption of antioxidants at 190° C.

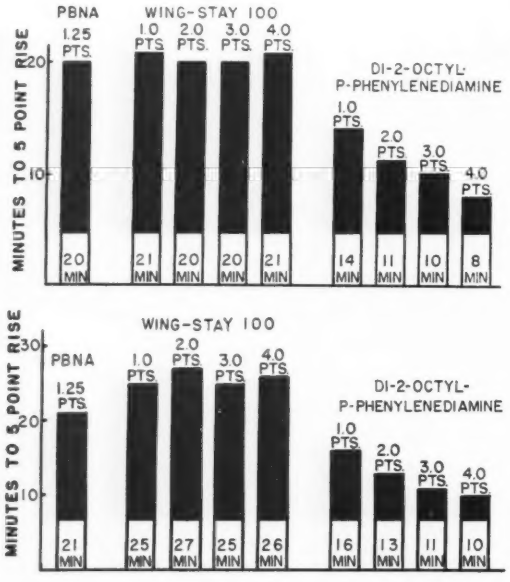

Fig. 4. Mooney scorch values for tread stocks containing various antioxidants: *top*, SBR 1500; *bottom*, SBR 1712

tests were made on standard dumbbell specimens.

Tensile retention after seven hours' air-bomb aging is shown in Figure 5. This graph shows that Wing-Stay 100 and AgeRite Resin D[3] are much better antioxidants for natural rubber than PBNA or AgeRite HP[4].

Sixty-six per cent. flex was obtained on samples before and after aging for seven hours in the air bomb on a Goodyear flexing machine not commercially available. In the 66% flex test a 0.9-inch sample with a 0.3-inch hole in the center is flexed from a relaxed position to 66% stretch at 360 cycles per minute at room temperature. Data are shown in Figure 6. All values are expressed on the basis of 100 for the unaged sample containing no antioxidant. Unaged data show the superiority of Wing-Stay 100 and AgeRite HP. After aging, Wing-Stay 100 is quite superior to all reference materials. This demonstrates the excellent high-temperature properties of natural rubber stocks containing Wing-Stay 100.

Various concentrations of Wing-Stay 100 were tested against 1.0 part of PBNA in the above natural rubber vulcanizate. Tests were made by oxygen absorption at 80° C. and by creep at 110° C. Both methods gave the same results, and only the oxygen absorption data are shown in Figure 7. These data indicate that 0.25 part of Wing-Stay 100 gives more protection than 1.0 part PBNA. The graph shows that there is a

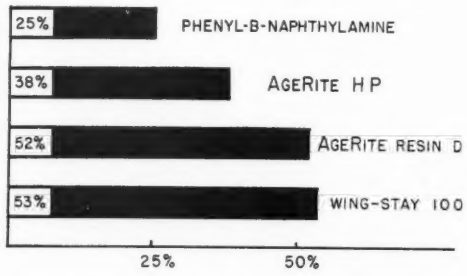

Fig. 5. % tensile retention of natural rubber tread stock aged seven hours in the air bomb at 120° C. and cured 70 minutes at 275° F.

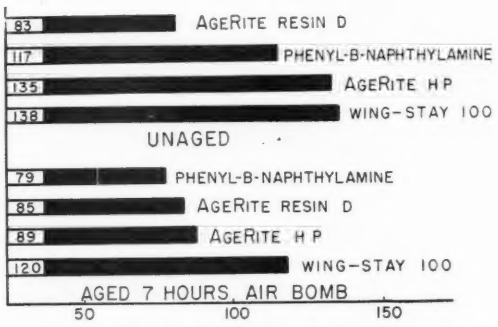

Fig. 6. Aged and unaged 66% flexing test results on natural rubber tread stock cured 70 minutes at 275° F. Values expressed on the basis of 100 for the original stock unaged

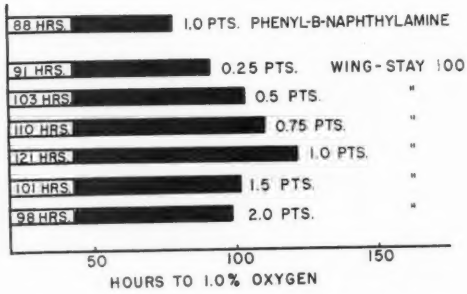

Fig. 7. Effect of concentration of Wing-Stay 100 on oxygen absorption at 80° C. on natural rubber tread stock cured 120 minutes at 275° F.

[3] Polymerized trimethyl dihydroquinaline, R. T. Vanderbilt Co., New York, N. Y.

[4] Blend of phenyl-beta-naphthylamine and diphenyl-p-phenylenediamine, Vanderbilt.

gradual increase in protection up to 1.0 part of Wing-Stay 100 and then a gradual decrease. Thus, for maximum protection and to avoid bloom the use of 1.0 part of Wing-Stay 100 in natural rubber is recommended.

Stabilizer for SBR

In SBR four aspects will be presented: namely, use of Wing-Stay 100 as a polymer stabilizer, as an antioxidant and antiozonant in SBR black stocks, and as a metal deactivator in SBR polymers and vulcanizates.

The polymers selected for this study were Plioflex 1712, 1500, and 1006. For each polymer samples containing 1.25 parts of PBNA or 0.5-part of Wing-Stay 100 were prepared from the same base latex. Coagulation was by salt-acid. For Plioflex 1712, 37.5 parts of Dutrex 8[5] were used as the extending oil.

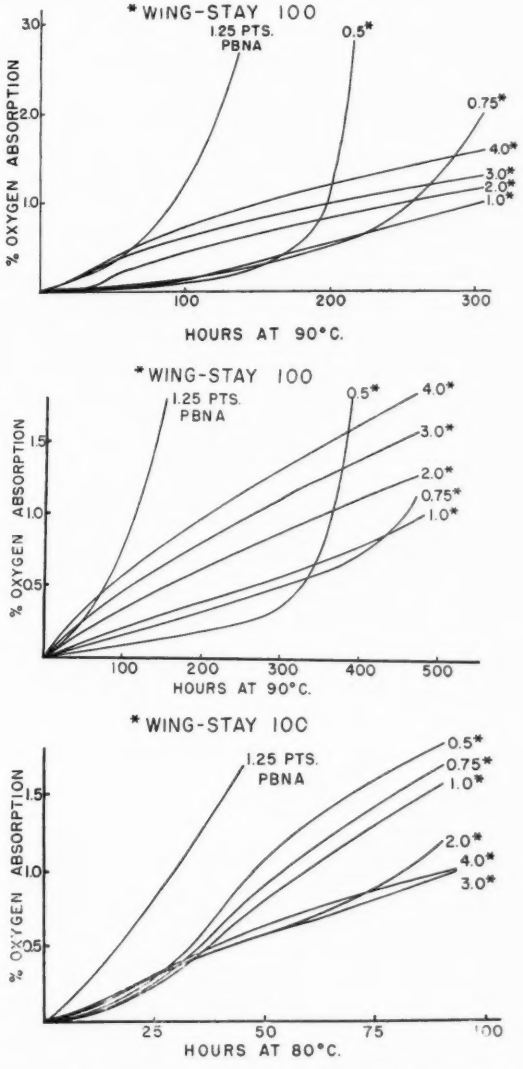

Fig. 8. Oxygen absorption for base polymers with various antioxidants: *top*, Plioflex 1500; *middle*, Plioflex 1006; *bottom*, Plioflex 1712

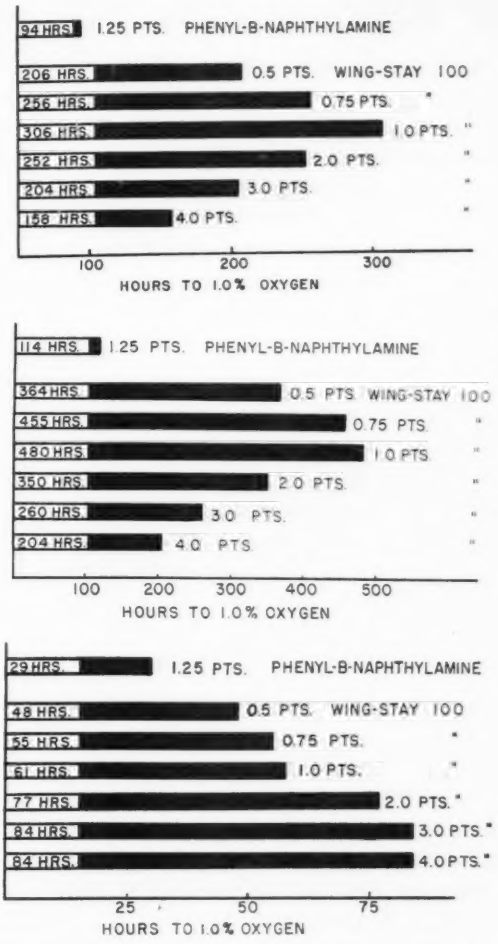
94 HRS. 1.25 PTS. PHENYL-B-NAPHTHYLAMINE
206 HRS. 0.5 PTS. WING-STAY 100
256 HRS. 0.75 PTS.
306 HRS. 1.0 PTS.
252 HRS. 2.0 PTS.
204 HRS. 3.0 PTS.
158 HRS. 4.0 PTS.
HOURS TO 1.0% OXYGEN
114 HRS. 1.25 PTS. PHENYL-B-NAPHTHYLAMINE
364 HRS. 0.5 PTS. WING-STAY 100
455 HRS. 0.75 PTS.
480 HRS. 1.0 PTS.
350 HRS. 2.0 PTS.
260 HRS. 3.0 PTS.
204 HRS. 4.0 PTS.
HOURS TO 1.0% OXYGEN
29 HRS. 1.25 PTS. PHENYL-B-NAPHTHYLAMINE
48 HRS. 0.5 PTS. WING-STAY 100
55 HRS. 0.75 PTS.
61 HRS. 1.0 PTS.
77 HRS. 2.0 PTS.
84 HRS. 3.0 PTS.
84 HRS. 4.0 PTS.
HOURS TO 1.0% OXYGEN

Fig. 9. Effect of concentration of Wing-Stay 100 on oxygen absorption at 90° F. of base polymers expressed as hours to 1.0% oxygen absorption: *top*, Plioflex 1500; *middle*, Plioflex 1006; *bottom*, Plioflex 1712

For oxygen absorption, the dry base polymer was dissolved in benzene, and the antioxidant added to the benzene solution to bring the concentration to the stated amounts. The cement so formed was poured on to a weighed aluminum foil sheet and allowed to evaporate. A known weight of polymer was deposited on the foil in a thin film and then placed into the oxygen absorption apparatus. Temperatures used for polymers were either 80 or 90° C.

In all SBRs, up to 4.0 parts of Wing-Stay 100 were tested to study the effects of concentration. This was done with the thought that if maximum antiozonant values of Wing-Stay 100 are to be obtained, more of the material is needed than is necessary for polymer protection. It may be more convenient to add the Wing-Stay 100 to the polymer during manufacture than later at the compounding stage.

Figure 8 (*top*) shows the oxygen absorption curves for Plioflex 1500. The bar graphs of Figure 9 (*top*)

[5] Petroleum process oil, Shell Oil Co., Inc., New York.

show the times required to absorb 1% oxygen. All concentrations of Wing-Stay 100 are superior to 1.25 parts of PBNA. Data show that maximum protection is obtained at 1.0 part Wing-Stay 100. As concentrations of Wing-Stay 100 are increased from 1.0 to 4.0 parts the time required to absorb 1% oxygen drops from 306 hours to 158 hours. The polymer stabilized with 1.25 parts PBNA absorbed 1% oxygen in only 94 hours.

In Figures 8 (*middle*) and 9 (*middle*) are shown the corresponding data for Plioflex 1006. The only difference between 1500 and 1006 polymers is that the 1006 polymer is somewhat more stable, as evidenced by the longer times required to absorb 1% oxygen.

Before the data for Plioflex 1712 polymers extended with 37.5 parts of Dutrex 8 are shown it might be well to review a little of the background of polymers extended with highly aromatic oils. The poor stability of such polymers is well known. Taft (10-11) and coworkers in numerous publications show the poor stability of these polymers. Their work points out that highly aromatic oils containing more than 15% nitrogen bases are particularly bad. Mitchell (12) demonstrates that these polymers are very sensitive to traces of metals, particularly iron salts. Reynolds (13) verifies Mitchell's work.

Various ways of stabilizing polymers containing highly aromatic oils have been published. Taft (14, 15) shows that Versene Fe-3[6] or β-coindendrol stabilize these polymers if used in appropriate quantities. Reynolds (13) recommends the use of magnesium soaps and gives data demonstrating their beneficial effects.

Any improvement over conventional antioxidants is highly desirable, provided it is not too costly. Wing-Stay 100 with its powerful antioxidant properties and its metal deactivating action should provide an excellent stabilizer for these oil-extended polymers.

Oxygen absorption curves for Plioflex 1712 polymers are shown in Figure 8 (*bottom*). Figure 9 (*bottom*) shows the time needed to absorb 1% oxygen. As in previous polymers, all concentrations of Wing-Stay 100 are superior to PBNA. In 1712, however, there is a gradual improvement in protection, at least, up to 3.0 parts of Wing-Stay 100. Thus, polymers containing 3.0 and 4.0 parts of Wing-Stay 100 take 84 hours to absorb 1% oxygen while those containing 1.0 part take 61 hours. The polymer containing 1.25 parts of PBNA absorbs 1% oxygen in only 29 hours.

Oxygen absorption data show that Wing-Stay 100 is an excellent stabilizer for SBR.

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(*To be continued*)

Trends in Rubber Research

(*Continued from page 862*)

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High-Pressure Cures in USSR

The vulcanization of natural and synthetic rubbers under pressures ranging from 40,000 to 140,000 psi. and temperatures of 120 to 200° C, were reported in the Russian journal, *Kauchuk i Rezina* [3, 5 (1958)], by I. S. Okhrimenko in an article, "Vulcanization of Rubbers under High Pressure." This was reported to be the first description in the literature and included the effect of fillers, plasticizers, and hardeners as well as some anti-oxidants and peroxides in high-pressure curing.

Fundamental Control Techniques

I—Frequency Distributions

By MASON E. WESCOTT

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The Author

Mason E. Wescott, professor of applied statistics, University College, Rutgers University, New Brunswick, N. J., is also Editor of the ASQC journal, "Industrial Quality Control." A more complete biography of Professor Wescott will be found with his first article in RUBBER WORLD, December, 1958, page 393.

IN A previous paper[1] an attempt was made to focus attention on some concepts fundamental to an understanding of the nature and purpose of the science of statistics as a discipline that has much to offer in the way of providing systematic strategies for coming to grips in a factual way with the everyday quality/cost problems that are generated by the inevitable presence of variation in the repetitive operations so characteristic of industrial processes. Variation plays a defense-in-depth game as one meets it on the firing line of industrial operations. Many of the traditional inspection routines simply do not penetrate this defense deeply enough to get the kind of information needed to disarm the problem and bring it to heel.

This is not to imply that there is a dearth of inspection *data*. All too often, just the opposite proves to be the case: literally reams of inspection data lie fallow in the files because no one really knows what to do with them. To be sure, much of this routine inspection data may exist in such a way as to be of little value for sound statistical analysis, which is all the more regrettable because data cost money. A decent respect for the value of good data, collected in the right volume, from the right sources, at the right time, in the right way, and for the specific purpose of being *used* to deliver recoverable information is an indispensable prerequisite for planning inspection and test procedures that get productive results.

An obvious corollary to these remarks is that some responsible agency within the company must know at least the fundamentals of statistical strategies in order to plan and direct data-gathering routines that yield observations susceptible to appropriate statistical analysis and thus *are* productive rather than wasteful. Although it is true that statistics must make sense, or there is something wrong with the statistics, the converse is not necessarily true: good "common" sense does not always lead to the collection of good statistical data *or* to good analysis of these data. What is needed in addition to "familiarity with the process," "know-how," or "experience"—indispensable as these are to sound quality control—is a speaking acquaintance with basic statistical techniques on the part of personnel responsible for the management of the quality control function.

It will be the purpose of this paper to describe one of the most fundamental of these techniques, viz., the structure and analysis of frequency distribution data.

Data for a Frequency Distribution

Any time we have (or get) two or more observed values of a variable, we have data that can be put in the form of a frequency distribution. This objective is accomplished simply by classifying the data with respect to a size scale. Of course if we have only a few observed values, the problem is quite trivial, and the resulting frequency distribution can tell us little (if anything) more than the unclassified data. But if we have a sample of 50 or more values, organizing these data to form a frequency distribution may prove quite revealing.

Before we become engrossed in the details of making and analyzing a frequency distribution, let us stop long enough to remark that neither this kind of data, nor any other kind, should be collected and worked over for the mere sake of "busy-work"! There

[1] RUBBER WORLD, Dec., 1958, p. 393; and Jan., 1959, p. 547.

Fundamental Control Techniques—I—Frequency Distributions

This article is the first of a series on quality control techniques by Prof. Mason E. Wescott of Rutgers University that will run in RUBBER WORLD during the next several months. We published in our December, 1958, and January, 1959, issues an article, "Fundamental Control Concepts," by Professor Wescott, which he had presented before the American Society for Quality Control's Chemical Division in October, 1958. This ASQC paper reviewed in a general way the basic concepts of variation, variation pattern, control charts, scientific acceptance sampling, and defect prevention. This new series of papers has as its purpose the presentation of more detailed information of the several basic concepts in the ASQC paper.

This first article of the series will describe one of the most fundamental techniques, viz., the structure and analysis of frequency distribution data. The preparation of a "grouped frequency distribution" in contrast to a "serial" or "ungrouped" classification is first explained and then illustrated. Then the standard normal frequency distribution curve is explained, and its use to make inferences and predictions about a given variable is reviewed.

The computation of the sample statistics of arithmetic mean and standard deviation for a given frequency distribution in which the value of the grouped frequency distribution mentioned above is illustrated then follows. Professor Wescott takes the same frequency distribution used as an illustration throughout this paper and shows how a typical problem may be studied by relating the given variable to the standard normal variable. He concludes this paper by indicating how other statistical methods can be brought to bear on related problems which he will present in subsequent papers of this series in the months to come.

should first be a recognized problem—a *purpose*—justifying the expenditure of time and effort invested in the collection and analysis of data. Unless this effort can be expected to contribute useful information not otherwise available, there is little (if any) point in making the effort.

The data in Table 1 are typical frequency distribution data. They represent the total production cost per day of a particular unit for 80 days randomly selected from records in the accounting department covering such experience for each day's operation during the 12 months preceding this study. The unit of measure is the nearest $10. Thus, the first figure, 135, represents a daily total production cost of $1350.

The problem that prompted the collection and analysis of these data was simply this: "What was the probable nature of the variation pattern in daily total production cost on this unit over the preceding 12 months?" The accounting department can readily furnish the least and the greatest daily cost, and probably even the average daily cost, but we want to know how these daily figures were distributed about this average and between these extremes. This unit was in production a total of 243 days during the preceding 12 months. We *could* use *all* this information to solve the problem proposed, but a random sum of 80 will be large enough to satisfy our needs without the necessity to process the complete record.

The sample was obtained by calling out the first 80 numbers on the range 1 to 243 in a table of random numbers and then pulling the days thus designated from the file records.

Note that we are working with *past* data. Frequency distribution data are almost always post-mortem data. If we have a problem associated with *current* performance, there are other statistical techniques that are likely to be far more useful than frequency distribution studies. Note also that we are attacking this problem on the basis of a random sample rather than using *all* the data available. The sample size of 80 is a purely arbitrary figure in this case. Sample size *could* have been determined by imposing certain requirements on inferences to be made from the data, but this was not done in the present case. A sample size of 50 or 60 or 100 or 120 would have been just as defensible as 80 for the purposes of this study, but something close to a third of the total record was chosen as a feasible compromise between too little and too much.

Making the Frequency Distribution

Begin by scanning the data to find the highest and lowest value recorded. These are 150 and 117 in Table 1. This is a total spread of 34. One could now simply write down all the integers from 117 through 150 and proceed to tally the 80 observed values against these 34 listed values of the variable. The result would be a frequency distribution. But with only 80 observations distributed over 34 distinct values, we would stand to have these 80 observations spread too "thinly" across the range 117 to 150 to give us any useful insight into the probable variation *pattern* existing in the total supply (universe, it is

TABLE 1. DATA FOR FREQUENCY DISTRIBUTION

(Data show total production cost per day for 80 randomly chosen days; unit of measure $10)

135	135	150	140	126	136	138	150
129	134	138	140	135	125	147	138
122	145	122	118	128	139	130	130
131	130	133	123	128	132	122	136
143	134	128	131	118	133	131	132
130	133	137	119	127	138	149	134
127	142	144	125	132	145	137	132
122	142	127	127	132	145	140	133
132	139	117	124	126	132	136	128
141	144	138	133	127	150	144	133

TABLE 2. FREQUENCY DISTRIBUTION FOR DATA IN TABLE 1

Class Interval	Tallies	Frequency	Mid-x
116–120	1111	4	118
121–125	11111 111	8	123
126–130	11111 11111 11111 1	16	128
131–135	11111 11111 11111 11111 11	22	133
136–140	11111 11111 11111	15	138
141–145	11111 11111	10	143
146–150	11111	5	148
		80	

called) of daily production cost from which the sample of 80 was drawn. We shall therefore classify these 80 observations into groups to form what is called a "grouped frequency distribution" in contrast to the "serial" or "ungrouped" classification described above.

Of course, if our only interest in these data were to compute sample statistics from it—such as average and standard deviation—then *neither* the serial *nor* grouped classification would be necessary: we would simply take the raw data as it stands in Table 1 and put it through the appropriate calculation procedures. However, the problem of frequency distribution analysis logically includes not only the calculation of the relevant sample statistics, but also the investigation of distribution *pattern*, and this latter can only be found by some classification scheme.

If we call the groups "class intervals," and if we take some convenient number, such as 5, for the length of a class interval, then a range of 34 values should give us about 7 groups. There is no satisfactory formula for deciding how many groups should be chosen for setting up a frequency distribution of observations, or, alternatively, how long a given class interval should be. We do prefer class intervals of equal length, and we do want a compromise between too few classes, which has the effect of over-condensing the raw data, and too many classes, which has the effect of spreading the data too thinly to bring into focus the probable variation pattern in the universe from which the sample came.

We shall choose a class interval of length 5 and begin at 116-120, 121-125, etc., but this is quite arbitrary—a class interval of length 4, beginning at 116-119, 120-123, etc. would be just as defensible and appropriate for these data.

Table 2 exhibits the result of using the class interval proposed, tallying the 80 observations into these classes, and summarizing these tallies into a class frequency column in which each entry is associated with the "mid-x" value of its class interval. Thus, in all further use of these data, the 16 observations, for example, in the class 126-130 will be assumed to have the value 128 rather than the actual individual values these 16 observations had in Table 1.

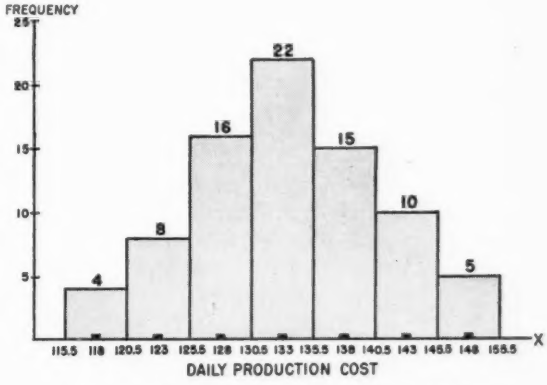

Fig. 1. Histogram for the data in Table 2

The Variation Pattern

The tally marks give a quick clue to the variation pattern inherent in the distribution of daily production cost figures for this unit of product. For practical purposes, the pattern suggested by the tally marks may suffice, but for more formal purposes we may want to exhibit this pattern as a histogram. Figure 1 shows the histogram for the data of Table 2. The histogram is virtually self-explanatory so far as its construction is concerned, except, possibly, to note that the frequency rectangles are contiguous, not separate, their respective boundaries being drawn at the "end-x" values of the class intervals 115.5, 120.5, 125.5, etc. This is because the geometric counterpart of frequency for a continuous variable (such as the data of this example) is a continuous area. We can imagine that if we had an unlimited amount of data classified into class intervals of ever shorter and shorter lengths across the range of the data, then we would expect these frequency rectangles to converge in outline to a smooth continuous curve, called a "frequency distribution" curve.

So a primary object of forming a frequency distribution table and its associated histogram is to see if the pattern that emerges can reasonably be identified with some known frequency curve model that can be

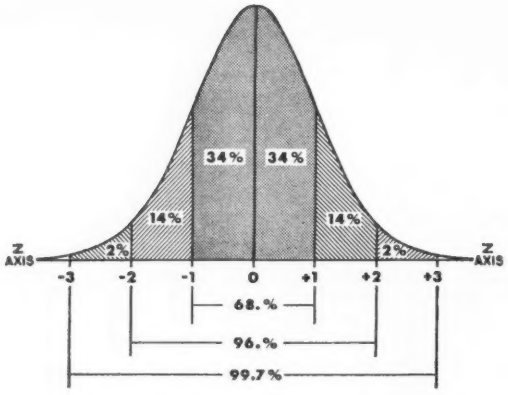

Fig. 2. Approximate areas for the standard normal frequency distribution curve. Each unit of Z represents one standard deviation of X

used as a mathematical (or probability) idealization for the universe from which the sample was drawn. In particular, we are interested in the possibility of being able to assume that the variable in question obeys the "normal distribution" law. This normal distribution model is one of the most fundamental probability models in both theoretical and applied statistics. Fortunately it is also one of the most commonly met patterns that we find when we organize data into a frequency distribution, because its properties are particularly simple and useful for making just the kind of inferences ("educated guesses") that we usually want to make about a universe from which we have drawn a sample.

The Normal Distribution Model

Figure 2 shows the contour of the standard normal frequency distribution curve and also the approximate areas over each unit of its baseline Z and between units of this baseline symmetric about the zero value of Z. The curve extends to infinity in both the positive and negative direction, but closes down on its baseline with such a high order of contact that 99.7% of the total area is contained over the interval from —3 to +3, that is, standard deviations of X about its mean. These area figures, particularly the 68 and 96% figures, are well worth remembering because they are essentially probability values. We shall have more to say about this matter later. Here our interest centers on the question, "Does the normal curve model appear to be reasonably well approximated by the data of our sample?"

If the answer is affirmative, we may proceed to use the properties of this model for making predictive and inference statements about the universe of our sample (in this case, the universe of daily production cost figures for the unit in question over the preceding 12 months in this particular plant). If the answer is negative, then some other model will need to be used, for it must not be supposed that *all* frequency data can be appropriately modeled by the normal law.

There exists a technique known as "the Chi-square goodness of fit test"[2] that can be used to test the validity of assuming that a set of frequency data came from a normal universe, but we shall not attempt to describe it here. Fortunately, the normal law is a very robust frequency model, and considerable liberties can be taken with its assumption as the underlying probability law without the risk of serious consequences. Generally a "look-test" applied to the histogram will suffice to decide the matter with sufficient safety. If the histogram is reasonably symmetrical about a single mode (mid-x with maximum frequency), and if the "pile-up" in the vicinity of this mode is neither too "flat" nor too "peaked," we shall certainly be on safe grounds in assuming our data can be modeled by the normal law.

There is also a graphical technique[2] for judging normality which makes use of "normal probability paper," but we shall omit discussion of it because it is more tedious to carry through than is the simple construction of a histogram, and also because when it *is* used, the final decision as to the reasonableness of the assumption of normality rests on nothing more refined than another "look-test," i.e., a subjective judgment.

A comparison of the histogram in Figure 1 and the normal curve pictured in Figure 2 suffices here to assure us that the assumption of normality is certainly reasonable and safe.

Computing Sample Statistics For a Frequency Distribution

Every frequency distribution has three important properties that need to be evaluated if we want to get out of the data the essential information that is in it, viz.: (1) shape; (2) central tendency; (3) dispersion about central tendency. We have already covered the property of shape, or variation pattern, for a set of frequency data.

Central tendency can be measured in several ways, but we shall discuss only one way, viz., the arithmetic mean. This will always be the preferred measure of central tendency unless the distribution is decidedly lopsided ("skewed" is the technical phrase), i.e., is definitely not symmetrical about the mode.

If we designate the variable under study by X, then the arithmetic mean, or simply the mean for short, may be symbolized as $\overline{X}$ (read "X-bar") and defined by $\overline{X}=(\Sigma X)/n$ where Σ means "sum of" and n stands for the total number of observations in the sample. This would be the formula to apply to the raw, ungrouped data.

If the data are grouped (as in Table 2), and if X now represents mid-x values and f represents the corresponding class frequency, then $\overline{X}=(\Sigma fX)/n$.

It will often be found simpler to code the data by letting X_0=mid-x of a class at or near the mode, and introducing a coded variable u where $u=(X-X_0)/c$ with c=length of class interval. In that case we have $\bar{u}=(\Sigma fu)/n$ and $X=\overline{X}_0+c\bar{u}$.

We shall presently illustrate these procedures by

[2] "Introduction to Statistical Analysis," Dixon and Massey, Second Edition, Chapters 1-6. McGraw-Hill Book Co., New York (1957).

applying them to the data which appears in Table 2.

The mean may be correctly considered to be the target at which the cause system that generated the observed values in our sample was aimed. But a whole host of factors operating in this cause system produced results that obviously missed this target and were instead scattered in a distribution pattern about it. This scatter, or deviation, of the data about its central tendency is called "dispersion."

Dispersion can be measured in various ways also, but the preferred yardstick for measuring it is called the "standard deviation," and for sample data is designated by the symbol s_X. The formula that defines this statistic is

$$s_x = \sqrt{\frac{\Sigma(X - \bar{X})^2}{n}}$$

We will not use this formula for computing s_X because there are simpler ways to do that, but let us see what this formula is doing. The amount (deviation) by which each X misses the target $\bar{X}$ is measured by $(X-\bar{X})$. Some of these differences are positive; some negative, and, of course, some *could* be zero, although this is relatively rare. In any event, if we add up all the positive deviations and all the negative deviations, and then combine these two totals, we will *always* get zero for an answer because $\bar{X}$ is, in fact, the fulcrum or center of gravity of all the n values of X; so the positive and negative deviations from $\bar{X}$ always balance out and add to zero.

One way to avoid this dilemma is to square each deviation. Now find the average of these squared deviations by adding them and dividing by n, i.e., $\Sigma(X-X)^2/n$. But this average is now a two-dimensional statistic because of the squaring operation; so we must take its square root to get it back to a one-dimensional yardstick for measuring dispersion. Thus we see that s_X has a formula that really makes sense: it gives each observation a chance to vote on this matter of dispersion by contributing in a positive way its own individual departure from target to the overall assessment of dispersion.

By straightforward algebra, it can be shown that a formula precisely equivalent to the defining formula is

$$s_x = \frac{\sqrt{n\Sigma X^2 - (\Sigma X)^2}}{n}$$

and this one is much more convenient for computing purposes. This would be the formula to use if we were to compute s_X from the raw, ungrouped data.

If we have data grouped (as in Table 2), so that X now stands for class interval mid-x, and f is the class frequency associated with X, then we get

$$s_x = \frac{\sqrt{n\Sigma fX^2 - (\Sigma fX)^2}}{n}$$

Finally, if the data have been coded (as previously explained), we will have

$$s_u = \frac{\sqrt{n\Sigma fu^2 - (\Sigma fu)^2}}{n}$$

and

$$s_x = c(s_u).$$

Table 3 shows a worksheet form for getting the totals called for by these formulae. Note how coding these data simplifies the computations, and how easy it is to decode the results back to original units of X. If we had worked directly with the ungrouped data, we would have obtained $\bar{X}=133.475$ and $s_X=7.893$ *vs.* the 133.375 and 7.575 values obtained from the particular grouping that led to Table 3. Thus, grouping the raw data into classes and working with mid-x values has resulted (as it always will) in some slight, but usually negligible grouping bias. Also, note that we have used divisor n in computing the standard deviation. For reasons it would be inappropriate to discuss here, it has become pretty standard practice to use divisor n—1 rather than n for computing s_X. However, in this introductory presentation it has seemed simpler and more understandable to work with divisor n, especially so since the sample size is as large as 80. It is only for small samples that the n—1 divisor makes any recognizable difference in the magnitude of s_X, and even for small samples it can be shown that all the inferences one would ever make about standard deviation can be made as simply and precisely with divisor n as with divisor n—1.

Some Inferences and Predictions Available from This Study

We have seen that these data strongly imply the normal distribution model as the underlying probability law governing variation in daily production costs. We shall now show how to relate the standard normal variable Z to the dimensional variable X of our data.

This is accomplished by the simple but fundamental relation

$$Z = \frac{X - \bar{X}}{s_x}$$

TABLE 3. CALCULATION OF $\bar{X}$ AND s_x FOR DATA OF TABLE 2

Code: $u = (X - 133)/5$; i.e. $X_o = 133$, $c = 5$

Class Interval	Mid-x X	Frequency f	Code u	fu	fu^2	Summation
116–120	118	4	−3	−12	36	n=80
121–125	123	8	−2	−16	32	$\Sigma fu = +6$
126–130	128	16	−1	−16	16	$\Sigma fu^2 = 184$
				−44		
131–135	133	22	0	+50	0	
136–140	138	15	1	15	15	$(\Sigma fu)^2 = 36$
141–145	143	10	2	20	40	$\bar{X} = 133.4$
146–150	148	5	3	15	45	$s_x = 7.6$
		80		+ 6	184	

$\bar{u}=6/80=0.075$; $\bar{X}=133+5(0.075)=133+0.375=133.4$

$s_u=[\sqrt{80(184)}-(6)^2]/80=\sqrt{14720-36}/80=$
$\sqrt{14684}/80=121.17/80=1.515$

$s_X=5s_u=5(1.515)=7.575=7.58$

Thus, for $X=\overline{X}$, we must have $Z=0$; for $X=\overline{X}+s_X$, we have $Z=1$; for $X=\overline{X}-2s_X$, we find $Z=-2$; et cetera.

It is seen that the "standard normal deviate Z" simply tells us how far a value of X deviates from its mean $\overline{X}$ by counting this departure in units of the standard deviation s_X. So a $Z=2.2$ refers to an X value that is 2.2 standard deviations above its mean, and a $Z=-1.4$ refers to an X value that is 1.4 standard deviations below its mean. Z is always a pure, dimensionless number, whatever dimensional unit may be appropriate for X.

We may now say that our best single estimate of the average of all the daily production costs is $\overline{X}=\$1334$, that about 68% of them varied between $\overline{X}-s_X$ and $\overline{X}+s_X$, i.e., between 1334 ± 76, or \$1258 to \$1410, and about 96% of them varied between $\overline{X} \pm 2s_X$, or 1334 ± 152, i.e., \$1182 and \$1486. In other words, on any random day when this unit was in production during the preceding 12 months there is about a 2 to 1 chance that the production cost for that day will be between \$1258 and \$1410 and about a 24 to 1 chance that it will be between \$1182 and \$1486.

If someone were to ask, "What per cent of daily production costs can be predicted to lie between \$1200 and \$1500?", we would need to consult a normal probability table,[3] but we would proceed as follows: \$1200 corresponds to $X=120$, and \$1500 to $X=150$. The Z values are then $Z_1=(120-133.4)/7.6=-1.76$, and $Z_2=(150-133.4)/7.6=2.18$. In a normal probability table[3], we would find that the area from minus infinity up to $Z_2=2.18$ is 0.9854, and the area from minus infinity up to $Z_1=-1.76$ is 0.0392; so the difference $0.9854-0.0392=0.9462$. Hence, we may estimate that about 95% of the daily production costs were between \$1200 and \$1500 during this 12-month period.

Suppose a goal of $\$1300 \pm \$100$ had been set for daily production costs. What percentage of the time was this standard maintained? Part of the answer to this we already have. We need $Z=(140-133.4)/7.6=0.87$ and the area from minus infinity up to $Z=0.87$, which is 0.8079. So $0.8079-0.0392=0.7687$, or about 77% of the time. Of the remaining off-standard days, about 4% (0.0392) ran lower than standard, and about 19% ($1-0.8079=0.1921$) exceeded standard.

If (as can well be expected) the normal variation pattern may be trusted to persist with essentially the same standard deviation, but increased costs of material and labor on this unit are estimated to average \$50 a day more, what standards should be set for the next 12 months' operation that have a 90% chance of being met? We would now have an average of $1334+50=1384$, or an $\overline{X}=138.4$ with $s_X=7.6$. (Actually the 7.6 figure as now being used is a σ_X, read "sigma-X", rather than an s_X figure since it is now being assumed as a universe parameter rather than a sample statistic. However, this refinement need not concern us here.)

What we do need to know are the Z values that include between them the middle 90% of the area under the normal curve. Consulting a normal table, we find $Z=\pm 1.645$. So we must solve for X in the equations $(X-138.4)/7.6=\pm 1.645$. The solutions are $X=125.9$ and 150.9. so standards could be set at 1259 to \$1509, or $\$1384 \pm \$125$ with about a 90% chance that they would be met under the conditions anticipated.

[3] "Statistical Quality Control," E. L. Grant. McGraw-Hill Book Co., New York (1952). See also Appendix to this paper.

Summary and Conclusions

There are other questions that could appropriately be asked (and answered) by these data, some of which involve techniques beyond the scope of this paper to discuss, but enough has been presented to indicate the way in which data can be collected, organized, and used for frequency distribution analysis to answer some worthwhile, practical questions that may be raised. In particular, it should be evident that these techniques of frequency distribution analysis could prove useful for studying a submitted lot of product from a stable process for the purpose of deciding whether a dimensional or performance quality characteristic of the item in question was normally distributed, and, if so, what proportion of the lot could be judged to be meeting specifications.

However, if our objective is to study a *process*—to ascertain its stability and capability relative to the natural tolerance it can be expected to hold—we need a different set of techniques: frequency distribution analysis is not enough. Remember, a frequency distribution study deals with a variation pattern over a *size* scale—what we need for effective *process* control is a data gathering and analysis strategy that makes possible the study of variation patterns with respect to a *time* scale. Variation with respect to a time scale is completely masked by frequency distribution data.

Finally, it should be rather evident that the data used for illustrative purposes in this paper are in a very real sense incomplete data, for it must be obvious that one of the major factors affecting the daily production cost is the number of units processed per day. In other words, these cost figures are certainly *related* in some way to volume of production—we have actually been looking at only half the total story here. From the realistic point of view it is unlikely that the problem originally proposed as a basis for study of these data would, in fact, actually be proposed. What is more likely is that the problem of *real* interest here would be this: "What is the relationship (if any) between daily volume of production and daily production costs?"

The relationship problem is a very frequent and practical problem, and the way the service of statistical methods can be brought to bear on it will be presented in a subsequent paper. All we have done here is to use half of the data in a typical relationship problem to serve as a vehicle for illustrating the way in which a frequency distribution study originates, the way relevant data may be collected and analyzed in the course of such a study, and some of the estimation and prediction uses to which such a study can be put.

There is an interesting (and factual) anecdote reported by Professor I. W. Burr on page 3 of the

TABLE B. AREAS UNDER THE STANDARD NORMAL CURVE

Z	0.09	0.08	0.07	0.06	0.05	0.04	0.03	0.02	0.01	0.00
−3.5	0.00017	0.00017	0.00018	0.00019	0.00019	0.00020	0.00021	0.00022	0.00022	0.00023
−3.4	0.00024	0.00025	0.00026	0.00027	0.00028	0.00029	0.00030	0.00031	0.00033	0.00034
−3.3	0.00035	0.00036	0.00038	0.00039	0.00040	0.00042	0.00043	0.00045	0.00047	0.00048
−3.2	0.00050	0.00052	0.00054	0.00056	0.00058	0.00060	0.00062	0.00064	0.00066	0.00069
−3.1	0.00071	0.00074	0.00076	0.00079	0.00082	0.00085	0.00087	0.00090	0.00094	0.00097
−3.0	0.00100	0.00104	0.00107	0.00111	0.00114	0.00118	0.00122	0.00126	0.00131	0.00135
−2.9	0.0014	0.0014	0.0015	0.0015	0.0016	0.0016	0.0017	0.0017	0.0018	0.0019
−2.8	0.0019	0.0020	0.0021	0.0021	0.0022	0.0023	0.0023	0.0024	0.0025	0.0026
−2.7	0.0026	0.0027	0.0028	0.0029	0.0030	0.0031	0.0032	0.0033	0.0034	0.0035
−2.6	0.0036	0.0037	0.0038	0.0039	0.0040	0.0041	0.0043	0.0044	0.0045	0.0047
−2.5	0.0048	0.0049	0.0051	0.0052	0.0054	0.0055	0.0057	0.0059	0.0060	0.0062
−2.4	0.0064	0.0066	0.0068	0.0069	0.0071	0.0073	0.0075	0.0078	0.0080	0.0082
−2.3	0.0084	0.0087	0.0089	0.0091	0.0094	0.0096	0.0099	0.0102	0.0104	0.0107
−2.2	0.0110	0.0113	0.0116	0.0119	0.0122	0.0125	0.0129	0.0132	0.0136	0.0139
−2.1	0.0143	0.0146	0.0150	0.0154	0.0158	0.0162	0.0166	0.0170	0.0174	0.0179
−2.0	0.0183	0.0188	0.0192	0.0197	0.0202	0.0207	0.0212	0.0217	0.0222	0.0228
−1.9	0.0233	0.0239	0.0244	0.0250	0.0256	0.0262	0.0268	0.0274	0.0281	0.0287
−1.8	0.0294	0.0301	0.0307	0.0314	0.0322	0.0329	0.0336	0.0344	0.0351	0.0359
−1.7	0.0367	0.0375	0.0384	0.0392	0.0401	0.0409	0.0418	0.0427	0.0436	0.0446
−1.6	0.0455	0.0465	0.0475	0.0485	0.0495	0.0505	0.0516	0.0526	0.0537	0.0548
−1.5	0.0559	0.0571	0.0582	0.0594	0.0606	0.0618	0.0630	0.0643	0.0655	0.0668
−1.4	0.0681	0.0694	0.0708	0.0721	0.0735	0.0749	0.0764	0.0778	0.0793	0.0808
−1.3	0.0823	0.0838	0.0853	0.0869	0.0885	0.0901	0.0918	0.0934	0.0951	0.0968
−1.2	0.0985	0.1003	0.1020	0.1038	0.1057	0.1075	0.1093	0.1112	0.1131	0.1151
−1.1	0.1170	0.1190	0.1210	0.1230	0.1251	0.1271	0.1292	0.1314	0.1335	0.1357
−1.0	0.1379	0.1401	0.1423	0.1446	0.1469	0.1492	0.1515	0.1539	0.1562	0.1587
−0.9	0.1611	0.1635	0.1660	0.1685	0.1711	0.1736	0.1762	0.1788	0.1814	0.1841
−0.8	0.1867	0.1894	0.1922	0.1949	0.1977	0.2005	0.2033	0.2061	0.2090	0.2119
−0.7	0.2148	0.2177	0.2207	0.2236	0.2266	0.2297	0.2327	0.2358	0.2389	0.2420
−0.6	0.2451	0.2483	0.2514	0.2546	0.2578	0.2611	0.2643	0.2676	0.2709	0.2743
−0.5	0.2776	0.2810	0.2843	0.2877	0.2912	0.2946	0.2981	0.3015	0.3050	0.3085
−0.4	0.3121	0.3156	0.3192	0.3228	0.3264	0.3300	0.3336	0.3372	0.3409	0.3446
−0.3	0.3483	0.3520	0.3557	0.3594	0.3632	0.3669	0.3707	0.3745	0.3783	0.3821
−0.2	0.3859	0.3897	0.3936	0.3974	0.4013	0.4052	0.4090	0.4129	0.4168	0.4207
−0.1	0.4247	0.4286	0.4325	0.4364	0.4404	0.4443	0.4483	0.4522	0.4562	0.4602
−0.0	0.4641	0.4681	0.4721	0.4761	0.4801	0.4840	0.4880	0.4920	0.4960	0.5000

Z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
+0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
+0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
+0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
+0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
+0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
+0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
+0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
+0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
+0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8079	0.8106	0.8133
+0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
+1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
+1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
+1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
+1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
+1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
+1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
+1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
+1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
+1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
+1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
+2.0	0.9773	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
+2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
+2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
+2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
+2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
+2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
+2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
+2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
+2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
+2.9	0.9981	0.9982	0.9983	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
+3.0	0.99865	0.99869	0.99874	0.99878	0.99882	0.99886	0.99889	0.99893	0.99896	0.99900
+3.1	0.99903	0.99906	0.99910	0.99913	0.99915	0.99918	0.99921	0.99924	0.99926	0.99929
+3.2	0.99931	0.99934	0.99936	0.99938	0.99940	0.99942	0.99944	0.99946	0.99948	0.99950
+3.3	0.99952	0.99953	0.99955	0.99957	0.99958	0.99960	0.99961	0.99962	0.99964	0.99965
+3.4	0.99966	0.99967	0.99969	0.99970	0.99971	0.99972	0.99973	0.99974	0.99975	0.99976
+3.5	0.99977	0.99978	0.99978	0.99979	0.99980	0.99981	0.99981	0.99982	0.99983	0.99983

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January, 1954, issue of *Statistical Quality Control* that is appropriate in connection with the role of frequency distributions. He was present at a meeting of company personnel at a plant where he had been retained as quality control consultant. The subject under discussion was rubber standards and specifications.

Quoting Burr directly, "During the discussion the vice president several times referred to the SQC viewpoint as 'your theories.' At the close of the meeting, after our decisions were reached I said I wanted to say a few words. I said to him, 'You have several times referred to "your theories" as something apart from practical production; so I would like to say something on this. Here you see a frequency distribution of nearly 2500 measurements on the thickness of rubber, which we have been using recently with no trouble. Now this frequency distribution is not "theory" to me, but is "facts." There is practice; it is what we are using. To my way of thinking, your "specification" might be called "theory," because, as you can see, about 52% of the rubber we have been using satisfactorily is above the upper specification! In this case the frequency distribution is practice and the specifications are theory if anything is."

Shake hands with a problem in your own area of experience that lends itself to a frequency distribution study—you may find the experience quite exciting and revealing!

APPENDIX

To be able to solve problems such as those illustrated in this paper, one needs access to a table of areas under the standard normal curve since it is just these areas that represent the probabilities sought. There are several (equivalent) ways to organize and present these areas in tabulated form, which leads to a variety of "normal tables" in the literature. Probably the most generally useful form of normal table is one that tabulates cumulated area from some value of Z near -3 to a corresponding value near $+3$. Such a table (B) [page 875] is given in this appendix.

In this table, values of Z appear in the left-most column and as column headings. Thus $Z_1 = -1.76$ locates the tabular entry 0.0392 found in row -1.7 and in column 0.06. The entry 0.0392 means that when Z has come from $-\infty$ up to -1.76, there has accumulated 3.92% of the total area under the standard normal curve. A Z_2 value of $+2.18$ locates the entry 0.9854 in row $+2.1$ and column 0.08, and this 0.9854 means that when Z has come from $-\infty$ up to $+2.18$ there has accumulated 98.54% of the total area under the standard normal curve. It should then be clear that the area *between* $Z_1 = -1.76$ and $Z_2 = +2.18$ would be the difference between what has been accumulated at $Z_2 = 2.18$ and what has been accumulated at $Z_1 = -1.76$, i.e., $0.9854 - 0.0392 = 0.9462$, and this is then the probability that a random value of Z would occur between -1.76 and 2.18. This is also then the probability for the random occurrence of an X value between the X value corresponding to Z_1 and the X value corresponding to Z_2, assuming X to be a variable that follows the normal probability law.

If one wants to find Z values that include the middle 90% of the area under the standard normal curve, he would need to search the body of this table to find the Z values at which 95% and 5% of the total area have been accumulated since $0.95-0.05 = 0.90$, i.e., 45% area on each side of $Z = 0$. In row 1.6, columns 0.04 and 0.05, one finds the entries 0.9495 and 0.9505, so $Z = 1.645$ locates the point at which 95% of the total area has accumulated. Similarly, in row -1.6 and columns 0.05 and 0.04, one finds the entries 0.0495 and 0.0505; so $Z = -1.645$ locates the point at which 5% of the total area has accumulated. Hence, the middle 90% of the area under the standard normal curve lies between $Z = \pm 1.645$; so there is a 90% chance that a random value of X would fall between the X values corresponding to $Z = \pm 1.645$ if X is a variable obeying the normal probability law.

Autoclave Heating Studied in USSR Tire Factory

The use of saturated steam, instead of superheated water, was investigated in the Yaroslavl' Tire factory laboratories in 1952 and was reported by M. A. Polyak and L. A. Kuvaldina in the Russian periodical, *Kauchuk i Rezina*, [22 (1958)], in an article called the "Investigation of Methods for Expediting the Vulcanization Process in Tire Manufacture."

This investigation showed that the use of saturated steam rather than superheated water as a heat transfer medium for vulcanizing in autoclaves produced a higher production rate. This was explained by the greater thermal capacity of the saturated steam in comparison with the superheated water, and data on this point were provided in the article.

The study explained how to resolve the problem on using the steam where the pressure required on the bag meant steam with a temperature of about 210° C.; while a temperature of about 150° C was desired. The difficulty was overcome by introducing the steam first at high pressure to bring the curing bag up to the desired temperature quickly and then injecting cold water to drop the temperature while maintaining pressure.

The work also was performed, using a combination of saturated steam and superheated water. The work was done on various-size tires including 8-ply and 14-ply types. The data included with the article show the time saving made by using either of the two methods. The time for different parts of the tire to reach the vulcanizing temperature was also presented in tabular form for both types of heating. Data were included for the effect on the strength of the cords and the bond strength between plies. The final tabulation showed the result of comparative road tests on tires produced by the new method and by the old.

The conclusions drawn were that there is a possible time saving of about 20% by using the saturated steam method and approximately 10% when using the combined steam and superheated water system for tire vulcanization.

MEETINGS and REPORTS

"Langley" and "Mooney Cure Test" before ASTM D-11

The "langley," the unit most widely used in pyrheliometry, or the measurement of solar radiation, and the most recent information on the use of the Mooney viscometer for calculating curing times for rubber compounds were discussed in two excellent papers before Committee D-11 on Rubber and Rubber-Like Materials of the American Society for Testing Materials at its meeting in Pittsburgh, Pa., on February 6. The meeting of Committee D-11 was preceded by meetings of 20 of its subcommittees, at which much important work in the field of testing was completed, and much more planned.

Simon Collier, Johns-Manville Corp., D-11 chairman, presided at the meeting of the main committee, assisted by D-11 secretary, John J. Allen, Firestone Industrial Products Co. Mr. Collier reported that two papers will be presented at the June, 1959, meeting of D-11, one on aging ovens, which will be a joint paper with Committee D-20 on Plastics, and the other, on compression set testing which will be a D-11 paper. In addition, the SAE-ASTM Technical Committee on Automotive Rubber will meet with Committee D-11 in June, 1959, for the first time in many years.

The members were reminded of the meeting scheduled for New York, October 26-31, 1959, of the International Standards Organization Technical Committee 45 on Rubber, which will be held at the Henry Hudson Hotel. This is a closed meeting, but the subcommittee chairmen of D-11, which comprise the American delegation to this ISO/TC 45 meeting under the sponsorship of the American Standards Association, will be attending this meeting with delegations from Europe and elsewhere in the world.

A week later, the International Rubber Conference, sponsored jointly by the Division of Rubber Chemistry of the American Chemical Society, ASTM Committee D-11, and the Rubber & Plastics Division of the American Society of Mechanical Engineers, will take place at the Shoreham and Sheraton-Park Hotels in Washington, D. C.

Mr. Collier then turned the meeting over to H. G. Bimmerman, of E. I. du Pont de Nemours & Co., Inc., vice chairman of D-11, and chairman of its program committee, who introduced the two speakers on the program.

"The Langley"

C. R. Caryl, of Desert Sunshine Exposure Tests, Phoenix, Ariz., explained and discussed the langley, at present the most satisfactory unit for timing outdoor exposure periods. This unit, which was proposed in 1947 and named after Dr. Samuel P. Langley, is equal to one gram calorie per square centimeter, or 3.69 B.T.U.'s per square foot. The United States Weather Bureau measures solar radiation in langleys at 94 of its own and cooperating stations, and every month publishes the data for each locality.

The Eppley pyrheliometer[1] is the instrument used by the Weather Bureau and by most outdoor testing stations to measure solar radiation; while a strip-chart potentiometer draws a daily graph of the data.

It was pointed out that the variations in the number of langleys from year to year in a given location are sometimes as much as the total langleys in a month. A cloudy day may have less than 100 langleys; whereas a cloudless day will total more than 600 langleys, and an hour may have from one to 100 langleys. While the langley is satisfactory for measuring solar radiation, the ideal unit for timing exposure periods should also record the effects of every other component of weather, including temperatures, moisture, wind, and airborne contaminants, it was said. These components of weather have been thoroughly discussed over the years, especially in a symposium on Conditioning and Weathering[2] and their effects on adhesives and plastics in another symposium.[3] It seems to be generally agreed, however, that light or solar radiation is the greatest single factor in the weathering of most materials, Mr. Caryl stated.

The sun hour or ultra-violet sun hour was next discussed, and the speaker presented data of his own and others on the testing of colorfastness to light of fabrics and of vinyl films which demonstrated that with the units of time and the sun hour so variable, there remains only the langley as the one unit that is an accurate measure of the most important factor of the weather, solar radiation. The sun hour is an hour when the intensity of solar radiation is more than 0.823 gm.cal./sq.-cm./min. The work of the Committee on Colorfastness to Light of the American Association of Textile Chemists & Colorists has proved the sun hour unreliable for use in color tests, and its definition based on a false assumption to the effect that little or no actinic degradation occurs below this 0.823 level, Mr. Caryl added.

In his investigations of the degradation of plastics, P. C. Woodland, of Dow Chemical Co., has shown the difficulty of finding an exposure unit satisfactory for all materials. Polyethylene was shown to be susceptible to both thermal and photoactivated oxidation, and to absorb ultra-violet in the carbonyl band (2800 Angstrom units); polyvinyl chloride also is degraded by heat, which causes discoloration and a very slow loss of mechanical properties, and by light which causes embrittlement and loss in tensile strength; polystyrene cannot be stabilized for long-term outdoor exposures and discolors only when exposed to radiation in the 2800 A. U. range.

An ideal exposure unit for these three classes of plastics might be the langley plus a factor for temperature plus data from an instrument sensitive to short-wave radiation in the 2800 A. U. band, Mr. Caryl suggested.

In concluding that the langley is at present the most satisfactory unit for timing outdoor exposure periods, the speaker said he has no particular interest in using one unit in preference to any other. He is timing exposures now in hours, days, and years, in langleys, and in sun hours, and will welcome any new unit that the ingenuity of man can devise.

The Mooney Cure Test

The usefulness of the data obtained in a Mooney cure test beyond the scorch time as a measure of the rate of cure has been recognized for some time,[4] A. E. Juve, B. F. Goodrich Research Center, first pointed out, in

[1] The Eppley Laboratory, Inc., Newport, R. I.
[2] ASTM Special Technical Publication No. 133, American Society for Testing Materials. 1916 Race St., Philadelphia, Pa.
[3] ASTM Special Technical Publication No. 132.
[4] India RUBBER WORLD, Nov. 1947, p. 216.

his paper, "Mooney Cure Tests for Calculating Curing Times." He then referred to the chapter on Physical Test Methods in the book, "Synthetic Rubber,"[5] edited by G. S. Whitby, in which he (Juve) had stated that "the time required to reach the approximate optimum could be calculated from the Mooney cure data by assuming that this time is made up of scorch time and the product of a constant and the time required for the viscosity to increase above the minimum viscosity a fixed number of units." The equation suggested at that time was as follows:

$$\text{Curing time} = T_s + 6T\,\Delta_{30}$$

where T_s is the scorch time or the time in minutes for the Mooney viscosity to rise five units above the minimum, and $T\Delta_{30}$ is the time required in minutes for the Mooney viscosity to rise 30 units above the scorch point.

This equation has been revised so that the factor of 10 instead of 6 times $T\Delta_{30}$ is now used because of the use of a different scorch point and the use of the large instead of the small rotor in the Mooney viscometer.

Several examples of how the calculated cure times from Mooney data correspond to stress-strain data for SBR, butyl, and neoprene rubber compounds were presented. In dealing with a stock said to have an optimum cure based on some property other than stress-strain, the Mooney cure test can be utilized to judge the effects of compound variations by first determining what constant in the formula will give the accepted value for optimum cure.

It was concluded that the Mooney cure test is a sensitive and reproducible test for measuring the delayed-action portion of the cure and for measuring the rate in the early part of the cure. From these data one can calculate an approximate optimum cure for a particular stock or equivalent cure times for different stocks.

Because the test involves only the early part of the cure period, it is necessary to exercise care in assuring that accurate measurements are obtained. The most common difficulty is that the viscosity curve in some cases exhibits an irregular rise due to partial crumbling of the stock.

In some instances when fast-curing stocks are compared with slow-curing stocks or when tests are run at different temperatures, the correction for time lag in attaining the test temperature becomes important.

Finally, Mr. Juve said, it would be desirable if the important features of the Mooney cure test, a continuous measurement as cure progresses on a single specimen of stock at curing temperature, could be extended to an appreciably longer time.

Subcommittee Meetings

Subcommittee 5—Wire and Cable. John T. Blake, Simplex Wire & Cable Co., chairman. The letter-ballot in the subcommittee on a proposed specification for "Synthetic Rubber Insulation for 75° C. Use in Wet and Dry Locations at Operating Voltages Not Exceeding 2000 Volts" included some negative votes, but these were not considered consistent with the policy established by subcommittee 5 for other specifications under its jurisdiction and will therefore be disregarded.

A large number of minor changes in other specifications developed by subcommittee 5, some editorial and some requiring letter-balloting, was voted.

"Tentative Specification for Construction of Rubber Insulated Wire and Cable," ASTM D 1350-58T, was discussed on the basis of whether it should be replaced by a more detailed specification, or whether a forthcoming specification by IPCEA would be sufficient and whether D 1350 should be dropped, and the IPCEA specification used to replace it. No decision was reached.

Subcommittee 6—Packings, R. F. Anderson, B. F. Goodrich Co., chairman. D. Messenger, Garlock Packing Co., reported for the task group on bringing D 1147-56T, "Method of Test for Compressibility and Recovery of Gasket Materials," in conformity with D 1170-58T, "Specifications for Nonmetallic Gasket Materials for General Automotive and Aeronautical Purposes." A revised Table 1 on "Conditioning and Test Loads for Gasket Materials" for D1147-56T was approved, and it was agreed to revise paragraph 2c of D 1147 to specify a dial gage graduated in 0.001-inch to measure sample thickness. A procedure for maintaining 50 to 55% relative humidity, similar to that described in paragraph 6b of D 1170, was approved for inclusion in D 1147. These proposed revisions will be submitted to letter-ballot in Committee D-11. Recommendations to revise paragraph 7 of D 1170 to bring it into agreement with the proposed D 1147 will be made to the chairman of Section 10 of ASTM-SAE Technical Committee on Automotive Rubber.

R. Fenstermacher, Keasby & Mattison Co., reported for the task group reviewing the proposed Committee C-13 specification for "Flexible Watertight Rubber-Type Gasket Joints for Circular Concrete Sewer and Culvert Pipe." The following recommended changes will be forwarded to Committee C-13 on Concrete Pipe: Standard Rubber Manufacturers Association tolerances for actual wall dimensions of the gasket should apply; maximum stretch of the gasket, when seated on the pipe, should be reduced from 20 to 10% of original circumference; the standard ASTM conditioning period of 22 hours at 158° F. should be used for the compression set determination; and that the maximum water absorption limit should be increased from 5% to 10%. Recommendations for tensile strength and durometer hardness specifications will be held in abeyance pending further information from gasket suppliers. It will be recommended that a seven-day oven aging period at 158° F. replace the proposed oxygen bomb aging requirement, but that the measurement of either tensile strength or elongation at break after aging will have to await the method established for measuring original tensile properties. It was recommended that the specification require the storage of the gaskets in cartons or burlap bags, and that inspection of the gaskets by the purchaser be made optional. Gaskets or container shall be marked to show quarter and year of manufacture, and gaskets more than two years in age shall be examined carefully prior to installation. Also, rubber gaskets shall be subject to rejections whenever they show surface checking, weathering, or other deterioration (excluding bloom) within a period of two years from date of manufacture.

A report from the chairman of the study group on gaskets and packing was read. Replies to a questionnaire circulated among various industrial groups to determine their position on further standardization on packing and gasketing materials have been forwarded to ASTM headquarters for analysis.

Subcommittee 8—Nomenclature and Definitions. R. G. Seaman, RUBBER WORLD, chairman. The task group headed by H. Bimmerman, E. I. du Pont de Nemours & Co., Inc., elastomer chemicals department, which had been appointed at the June, 1958, meeting to develop definitions for rubber, rubber-like materials, and elastomers, reported that it had met in Akron, O., December 8, 1958, and had circulated proposed definitions to about 150 leading technologists. As a result of the many replies received and the wide variation in the comments in these replies, the task group met again prior to this meeting of subcommittee 8 and prepared a further revision of these definitions, which was read to those present. After much discussion, during which it became evident that there was wide disagreement as to the value of the most recent version of these definitions, a motion was made, seconded, and passed to refer the whole matter back to the task group again for further study.

A request for classification and coding of Hypalon, or chlorosulfonated polyethylene; polypropylene; Teflon, or polytetrafluoroethylene; Kel F Elastomer, or chlorotrifluoroethylene and vinylidene fluoride copolymer; and Viton, or hexafluoropropylene and vinylidene fluoride copolymer, accord-

[5] John S. Wiley & Sons, Inc., New York (1954).

ing to D 1418-58T, "Recommended Practice for Nomenclature for Synthetic Elastomers and Latices," has been received. Comments and suggestions from B. S. Garvey, Pennsylvania Industrial Chemicals Corp., and R. D. Stiehler, National Bureau of Standards, were reviewed, and the chairman of subcommittee 8 was authorized to appoint a task group to develop a recommendation for classification of these customers.

Subcommittee 9—Insulating Tape. C. W. Pickells, Consolidated Edison Co. of New York, chairman. Proposed revisions of D 69-57T, "Specifications for Friction Tape for General Use for Electrical Purposes"; D 119-57T, "Specifications for Rubber Insulating Tape"; and D 1373-57T, "Specifications for Ozone Resistant Rubber Insulating Tape," have been approved by subcommittee 9 and are recommended for letter-ballot in D-11.

The chairman of the task group on Water Resistant Rubber Tape has drafted a specification for such tape and has received comments from members of his group. The specification and comments will be sent to all members of subcommittee 9 for further consideration, and a revised draft of the specification will be presented at the June, 1959, meeting.

The test section will prepare proposed methods for testing of semiconducting rubber tape used in the construction of rubber insulated cable.

Subcommittee 10—Physical Testing. L. V. Cooper, Firestone Tire & Rubber Co., chairman. Although no meeting of this subcommittee had been scheduled a meeting was held for the purpose of reactivating the task group on the testing of O-rings in order to consider the expansion of D 1414-56T, "Method for Tension Testing of O-Rings." Mr. Messenger, Garlock Packing, agreed to serve as chairman of the task group.

In the absence of Mr. Cooper, B. G. Labbe, of Firestone, presided at this meeting of subcommittee 10.

Subcommittee 11—Chemical Tests. W. P. Tyler, B. F. Goodrich Co., Research Center, chairman. The task group on the analysis of rubber chemicals submitted a proposed method for the determination of specific gravity, which was discussed in subcommittee 11. Some further work is required in connection with some of the details of the method for determination of solubility.

Subcommittee 11 has been working on a proposal to consolidate and clarify the methods of analysis of both raw rubbers and rubber products now existing in D 297-55T, "Methods for the Chemical Analysis of Rubber Products," and D 833-46T, "Methods of Analysis and Identification of Synthetic Elastomers." Subcommittee 11 recommends to Committee D-11 that the contents of D 833-46T be transferred to D 297-55T as an additional section and with the necessary revisions, following which D 833 be withdrawn as a tentative standard.

Subcommittee 11 will cooperate with subcommittee 12 also in connection with the location and the elimination of duplication of methods of tests for crude natural rubber common to both D 297-55T and D 1278-58T, "Tests for the Chemical Analysis of Natural Rubber."

A task group will be appointed for carrying through to completion the incorporation of D 833 into D 297, which includes the addition of new methods for the determination of zinc and titanium, rapid reflux extraction methods, better methods for the determination and identification of synthetic elastomers, etc. Completion of this work also depends on adoption of new definitions of terms by Committee D-11.

Continued investigation of new methods will also be carried on to implement the work of the editorial revisions task group.

Subcommittee 13—Synthetic Elastomers. B. S. Garvey, Jr., Pennsylvania Industrial Chemicals Corp., chairman. Section 1 on Sampling, headed by L. G. Mason, B. F. Goodrich Co., reported that random sampling of SBR bales for wet spots had been suggested, but no action was taken on this suggestion. The choice of sampling methods in D 1485-57T, "Methods of Sampling and Sample Preparation of Synthetic Elastomers," will continue to be available, therefore, as referee methods. A proposal to add the sampling of SBR black masterbatches to D 1485-57T will be letter-balloted in subcommittee 13.

E. J. O'Conner, Goodrich-Gulf Chemicals, Inc., reported for Section 2 on Chemical Tests in the absence of B. C. Pryor, also of Goodrich-Gulf. A method for determination of oil content and total extract in SBR oil masterbatches has been circulated in Section 2 and after March 1 will be tried out in a round-robin test on samples containing 25, 37½, and 50 parts of oil. Two more members of subcommittee 13 will be asked to participate in the investigation on the use of the method for the determination of antioxidants in SBR oil masterbatches.

R. S. Hammer, Phillips Petroleum Co., will contact both producers and consumers in an effort to develop a method of test for the determination of oil in oil-black masterbatches. Editorial changes have been incorporated into paragraph 62 of D 1416-58aT, "Method of Analysis of Synthetic Elastomers," in connection with the determination of mixed alkylated phenol antioxidant.

Subcommittee 13 will submit to letter ballot in Committee D-11 the following addition to Table II of D 1419-58T, "Description of Types of Styrene-Butadiene Rubbers," in order more accurately to identify oil types: PAR, Viscosity Gravity Constant (VGC), 0.790-0.849; NAPH, Naphthenic, VGC, 0.850-0.899; AR, Aromatic, VGC, 0.900-0.949; HI-AR, Highly Aromatic, VGC, 0.950 and above.

H. R. Norsworthy, Texas-U.S. Chemical Corp., reported for Section 3 on Physical Tests in the absence of W. G. Orr, of the same company. The lack of an acceptable standard HAF black has prevented tests to establish a recipe for testing oil masterbatches. A recipe for testing SBR 1502 or 1712 has now been agreed upon, which will contain 50 parts of HAF black on 100 of rubber, five parts of zinc oxide, two parts of sulfur, one part of Santocure, and for 1712 only 1.5 parts of stearic acid. A reference Lot No. 1 of HAF black is expected to be available from carbon black producers by March 7.

Using this black and the above recipe, 14 laboratories will participate in a round-robin testing program in which a freshly made reference lot of Santocure will also be used. Tensile strength, elongation at break, and stress at 300% elongation will be determined for a range of cures at 292° F., and the results will be submitted at the June, 1959, meeting of subcommittee 13. A separate task group under G. C. Maassen, R. T. Vanderbilt Co., and from another subcommittee will submit a revision of recipes and assignment of synthetic rubbers in D 15-58T, "Method of Sample Preparation for the Physical Testing of Rubber Products."

In connection with the assignment of numbers of SBR, the following addition to D 1419-58T to clarify the assignment of numbers which identify SBR black masterbatches and SBR oil-black masterbatches in Tables I and II, will be submitted to letter ballot in Committee D-11:

"With 14 or less parts oil per hundred styrene-butadiene rubber hydrocarbon (SBR), the number will classify descriptive types as follows: 50 to 99, 'Hot' black masterbatch; 150 to 199, 'Cold' black masterbatch; 1600 to 1699, 'Cold' black masterbatch.

"With 15 or more parts oil per hundred styrene-butadiene rubber hydrocarbon (SBR), the number will classify descriptive types as follows: 250 to 299, 'Cold' oil-black masterbatch; 1800 to 1899, 'Cold' oil-black masterbatch.

The following number for latices (except 2113) were assigned and approved by subcommittee 13 in June, 1958, for addition to D 1417-57T, "Methods for Testing Synthetic Rubber Latices (Styrene-Butadiene Copolymers)," Table I.

Type of Latex	Drying Aid	Drying Time Min.
SBR 2076	1 ml. of distilled water	45
2107	"	45
2108 (X765)	"	45
2109	"	45
2110	"	45
2111	"	45
2112	"	45
2113	"	45

SBR 2113 was approved in February, 1959, for addition to D 1417-57T and D 1420-58T, "Description of Types of Styrene-Butadiene (SBR) and Butadiene Rubber (BR) Latices." Property values of 2113 in D 1420-58T will be as follows: nominal total solids, 48%; nominal bound styrene, 44% nominal pH value, 10.5; nominal residual volatile unsaturates, 0.1%; contained polymer nominal Mooney, ML/212° F., 140; nominal conversion, 80%; emulsifier, mixed; catalyst, OHP; shortstop, ND; activator, FRA; nominal temperature °F., 43.

Addition to D 1419-58T by Dr. Garvey in the SBR 1600 series to cover a cold rubber black masterbatch containing 50 parts of EPC black, as requested by Phillips Chemical Co., was approved.

Considerable discussion took place on a motion which lost on replacement of the word "experimental" by the word "commercial" in paragraph 2 (b) of D 1419-58T as it pertains to code numbers assigned to producers of SBR in Table I. The chairman of subcommittee 13 was authorized to appoint a task group to recommend action at the June, 1959, meeting for revision of D 1419-58T in this connection.

It was noted that subcommittee 8 on nomenclature of D-11 will take action on assignment of code letters in D 1418-58T, for elastomers with rubber-like properties made from chlorosulfonated polyethylene and vinylidine fluoride and hexafluoropropylene.

Subcommittee 14—Abrasion Tests. R. F. Tener, National Bureau of Standards, chairman. The last D-11 letter-ballot on the revision of D 394-47, "Methods of Test for Abrasion Resistance of Rubber Compounds," recorded two negative votes, and the "Proposed Tentative Standard for Determining the Abrasion Resistance of Rubber Heels and Soles," received five negative votes. The two negative votes on D 394-47 and four of the five negative votes on the "Proposed Tentative Standard for Determining the Abrasion Resistance of Rubber Heels and Soles" were resolved. Subcommittee 14 recommends the adoption by D-11 of the revised and proposed tentative methods.

Subcommittee 15—Life Tests. G. C. Maassen, R. T. Vanderbilt Co., chairman. G. N. Vacca, Bell Telephone Laboratories, chairman of the task group on oven aging of plasticized polyvinyl chloride and highly plasticized elastomers, reported that the results of the first round-robin test were inconclusive because of air flow variations in the various test ovens. A second round-robin test program is being conducted with air flow conditions and sample placement closely specified.

Markus Royen, Apex Tire & Rubber Co., has developed ovens in which special baffles are provided to control air flow and in which the samples are exposed in horizontal tubes. Mr. Royen will be invited to present a paper on these new ovens at the June, 1959, meeting of Committee D-11. The chairman of subcomittee 15 requested approval of D-11 to invite Committee D-20 on Plastics to the presentation of Mr. Royen's paper.

A. G. Veith, Goodrich Research Center, chairman of the task group on revision of D 1149-55T, "Method of Test for Accelerated Ozone Cracking of Vulcanized Rubber," has contacted numerous people on the countercurrent extraction column method of analysis and reported that nine laboratories have agreed to investigate the use of these columns, and they have been sent to four laboratories. One laboratory has reported favorably on the method to date, and more results will probably be available at the June, 1959, meeting.

J. E. Norton, Atlas Electric Devices, chairman of the task group on the plastic chip method of determining light sources, reported that work is progressing and that a final report may be available in June. Committee D-20 also is working on this problem.

In the meeting of subcommittee 29 on Compounding Ingredients on February 4, it was stated that Committee D-24 on Carbon Black needed a standard method for the determination of staining of carbon blacks, that is, the staining of white rubber compounds in contact with compounds containing carbon blacks. The advisory committee of Committee D-11 decided that this problem should be handled by subcommittee 15. F. W. Barlow, Thermatomic Carbon Co., of Committee D-24 defined the problem as follows:

"There is a benzene extraction color test now used on carbon blacks. The problem is to obtain correlation between the benzene test and actual discoloration of a white rubber compound in contact with a compound containing carbon black."

A task group to include carbon black producers and consumers will be formed to work out a method of test for determination of the staining of carbon blacks as outlined above.

Subcommittee 16—Description and Classification of Rubber Compounds. J. F. Kerscher, Goodyear Tire & Rubber Co., chairman. A proposal by R. D. Stiehler, NBS, for a basic classification or coding system for rubber compounds consisting of five numerals wherein the first number denotes aging, the second swell resistance, the third hardness, and the fourth and fifth combined designate the desired level of elongation, was discussed. Subcommittee 16 itself will not work directly on Dr. Stiehler's proposal at this time, but will await the progress made by Section IV-D-3 of SAE-ASTM Tech A Committee, since this latter group has given previous consideration to some phases of this proposal. A task group of subcommittee 16 will be appointed to work with Tech A, however, in further development of a suitable system since the subcommittee seems to favor a classification of the type suggested by Dr. Stiehler as modified by Tech A.

The current status of the "expanded tabular" system of D 735-58T, "Specifications for Elastomer Compounds for Automotive Applications," being developed by Section IV-D-3 of Tech A, was reviewed from copies of the minutes of the last two meetings of the Section. The Tech A group has adopted the idea of putting significance into prefix designations being proposed in its expanded tabular system. Whereas originally "R," "SB," and "TA" were arbitrarily selected to denote various polymers, a new system has now been devised where the first alphabetical letter will refer to a form of heat aging and the second to a degree of swell resistance. It is believed that by this means any polymer, whether presently available or still to be developed, would fit into this system.

Subcommittee 17—Hardness Set and Creep. Sherman R. Doner, Raybestos-Manhattan, Inc., chairman. Paul Ruese, Goodyear, called attention to the fact that the "raised platform and spherical presser foot" gage used to measure the thickness of compression set buttons in D 395-55, "Tests for Compression Set of Vulcanized Rubber," was not clearly defined. The chairman of the subcommittee agreed to rewrite paragraph 4d and to circulate his recommendations so that final action could be taken at the June, 1959, meeting.

Ross Shearer, Goodrich Research Center, gave a report on the work of his task group which has been working on the effect of using lubricated specimens, sandpaper confined specimens, and regular D 395-55 specimens. No significant improvement can be claimed for the lubricated specimens as suggested by England and the ISO TC/45 groups. This task group is also comparing the use of molded *versus* die cut compression set specimens, and a report on this phase of the work will be made in June, 1959.

R. S. Havenhill, St. Joseph Lead Co., supplied the requested procedure for conditioning the durometer for low-temperature hardness determinations. His recommendations will be circulated in subcommittee 16 for letter-ballot before the June meeting.

Section Q, Subcommittee 1 of Committee D-20 on Plastics, has written a durometer hardness test proposal combining D 676-58T, "Test for Indentation of Rubber by Means of a Durometer," and D 1484-57T, "Test for Penetration of Hard Rubber by Type D Durometer," with some modifications. The chairman of the three subcommittees in D-11 and D-20 involved in this matter will be asked to meet and discuss this proposal before the June, 1959, meeting.

Subcommittee 19—Tests for Properties of Rubber and Rubber-Like Materials in Liquids. F. H. Fritz, Du Pont, chairman. It was agreed to accept the recommendations of SAE-ASTM Tech A Committee with regard to the addition of Reference Fuel C to D 471-57T, "Method of Test for Change of Properties of Elastomeric Vulcanizates Resulting from Immersion in Liquids." (Reference Fuel C consists of a 50/50 by volume mixture of iso-octane and toluene.) This recommendation will be submitted to letter-ballot in D-11.

Task group A was asked to define the scope of its activities as a prelude to an investigation of specific changes in procedure or testing fluids that may be necessary to "modernize" D 471-57T. The scope should include such factors as maximum temperature limitations, types of test fluids required, and changes in weighing procedures necessary to facilitate accuracy. A new chairman of task group A will be appointed in view of the resignation of A. C. Simon, H. O. Canfield Co. of Virginia. Several editorial changes in D 471-57T will be letter-balloted in the subcommittee.

Subcommittee 20—Adhesion Tests. H. H. Irvin, Marbon Chemical Division, Borg-Warner Corp., chairman. Comments on a draft proposal of the International Standards Organization's Technical Committee 45 on Rubber on the subject of rubber-to-metal adhesion are being circulated. This proposed ISO/TC 45 method and D 429-58, "Method of Test for Adhesion of Vulcanized Rubber to Metal," are now very similar, and this situation will be reviewed at the June, 1959, meeting following further receipt of all available comments.

The question of sponsorship of D 413-39, "Methods of Test for the Adhesion of Vulcanized Rubber to Metal (Friction Test)," as well as textile, wire and rubber-to-metal adhesion testing will be discussed between representatives of subcommittee 20 and 21 on Rubber Cements at a special meeting to be arranged in the near future at the request of Committee D-11.

Steps are being taken to develop standard values of K_1 (adhesion-to-metal bond made during vulcanization) and K_2 (adhesion cemented bond made after vulcanization), and specification suffixes for D 735-58T, "Specifications for Automotive Elastomer Compounds." J. F. Anderson, Goodrich, is the liaison man between subcommittee 20 and Section IVw of ASTM-SAE Tech A where most of this work is being done.

The task group headed by P. J. Larsen, Lord Mfg. Co., working on expanding the usefulness of D 429-58 by including specifically defined environmental conditions for testing, expects to make a progress report at the June, 1959, meeting.

H. Macey, Goodrich Research Center, will continue his investigation of reported significant advances in the field of non-destructive testing and their possible application to the work of subcommittee 20.

Subcommittee 21—Rubber Cements. J. F. Anderson, Goodrich, chairman. The ultrasonic method for non-destructive testing of bonds between friction materials and metals has been approved by letter-ballot in Committee D-11, and one negative vote resolved. The secretary of D-11 will refer the method to the chairman of Committee E-7 on Non-Destructive Testing for comment.

Further work on the disk shear test for metal-to-metal bonds in D 1205-58, "Methods of Testing Adhesives for Brake Linings and Other Friction Materials," is still being held up pending action by ASTM-SAE Tech A Committee.

A new tension adhesion test for bonds between friction materials and metals, scheduled for presentation at Pittsburgh, was not described because of illness of the task group chairman, C. R. Lupton, Bendix Aviation Corp.

The request for the development of a standard coated fabric for use in testing seam cements will be worked out in cooperation with subcommittee 24 on Coated Fabrics.

A. E. Hicks, General Tire & Rubber Co., chairman of the task group on methods of test of tire cord adhesion, reported that interest in this project is widespread, and a program for future work has been established. The task group will be divided into two sections: one to work on methods of test for the adhesion of textile cords, under G. R. Harrison of Du Pont; the other, to work on methods of test for adhesion to wire cord and bead wire, under R. H. Herzog, of John A. Roebling's Sons Corp.

Subcommittee 22—Cellular Rubber. H. G. Bimmerman, Du Pont, chairman. Several negative votes were recorded on the last Committee D-11 letter-ballot in connection with the tentative methods of tests and specifications for closed-cell polyvinyl chloride sponge. A. F. Sereque, Goodrich, was not present at the meeting, but he reported that he could reconcile these objections. When the negative votes are withdrawn, the specification can be sent to ASTM headquarters for publication.

There was considerable discussion on the means of designating urethane foam grades, as reported by G. H. Barnes, Goodyear, with references to their possible confusion with those used in D 735-58T. Several suggestions were made for letter prefixes and two- and three-digit systems for indicating the type and compression-deflection or indentation range. Recommendations for designation systems will be prepared. The chairman of subcommittee 22 will discuss this matter with Neil Catton, of Du Pont and of Tech A Committee in order to avoid future conflicts.

Subcommittee 23—Hard Rubber. W. J. Dermody, Electric Storage Battery Co., chairman. It was reported that section Q, subcommittee 1, Committee D-20 on Plastics, has completed a letter-ballot on a proposed method of test for penetration hardness of plastics by means of the durometer, which is practically a verbatim transcript of D 676-58T, "Test for Indentation of Rubber by Means of a Durometer," and D 1484-57T, "Test for Penetration of Hard Rubber by Type D Durometer," except for the material on scope and significance and an added requirement for statistical treatment of data. The proposed D-20 method differs from the D-11 methods, D 676-58T and D 1484-57T, in that the former is restricted to plastics, and the last two refer to rubber and hard rubber, respectively.

Liaison with Committee D-20 was established in February, 1957, for the purpose of cooperative work on physical test methods applicable to both hard rubber and plastics. D-20 in June, 1957, requested joint D-11 and D-20 jurisdiction for D 676-58T, but has not requested similar action on D 1484-57T, and if D-20 favors unilateral action on their proposed tentative method on hardness while the two D-11 methods are still in force, subcommittee 23 is opposed.

The resignation of R. J. Wentland, Richardson Co., from Committee D-11 leaves subcommittee 23 without liaison with Committee D-20. Replacement of Mr. Wentland has been deferred to allow D-20 to suggest someone from the Plastics Committee for this assignment.

Task group 6 on the revision of D 530-57T, "Methods of Testing Hard Rubber Products," has been activated with instructions to prepare a revision of the method in accordance with the opinions expressed in a recent subcommittee 23 questionnaire. J. R. Smyth, Electric Storage Battery, will become chairman of this task group, and Sam

Shore will replace Mr. Wentland on task group 6.

Task group 1 has demonstrated the reproducibility of the ball-drop impact test and will draft a revision of the method and recommend it to task group 6 for inclusion in D 530-57T.

Task group 4 has revised its tentative proposals for grades of hard rubber and will continue this work. A. W. Moline, American Hard Rubber Co., has been added to task group 4. Task group 7, through subcommittee 23, requested authorization from Committee D-11 to change the scope of D 639-57T, "Methods of Testing Asphalt Battery Containers," to include both hard rubber and asphalt composition battery containers.

Subcommittee 24—Tests for Coated Fabrics. K. L. Keene, United States Rubber Co., chairman. It was agreed to investigate and recommend for adoption a method for the determination of the flame resistance of coated fabrics. A task group headed by K. L. Winkley was appointed. Mr. Keene will conduct a round-robin test program, and a report will be made at the June, 1959, meeting.

The subcommittee chairman was authorized to submit a request to subcommittee 25 on Low-Temperature Tests, asking it to assume the responsibility for developing a suitable cold resistance test for coated fabrics. Copies of 21 different test methods now in use for determining cold crack resistance of coated fabrics will accompany this request.

Although the report of the task group chairman on a comparison of 2 *vs.* 12 inches per minute jaw separation speed for adhesion testing was not presented because of the absence of the chairman, the results will be circulated within subcommittee 24 together with a letter-ballot. Similarly, the report of the tack tear test task group was not presented, but the results of his work will be circulated in subcommittee 24, together with a letter ballot.

J. V. Hovorka, Ford Motor Co., presented copies of 11 different test methods for coated fabrics which are in current use by the automotive industry, but which are not covered by ASTM test methods. After circulation of these methods among all members of subcommittee 24, they will be discussed at the June, 1959, meeting, and task groups will then be appointed to investigate those methods which the subcommittee approves for consideration.

Subcommittee 25—Low Temperature Tests. R. S. Havenhill, St. Joseph Lead Co., chairman. Written comments on ISO/TC 45 (Sec. 248) Document 387 on Low Temperature Stiffness and (Sec. 250) Document 389 on Low Temperature Brittleness by Messrs. Ofner and Shearer were approved for submission to ISO/TC 45 through Irving Kahn, Watertown Arsenal.

R. G. Dunlop, Smithers Laboratories, reported that 11 laboratories are participating in the round-robin test program to determine the speed of the Scott Testers solenoid impact test apparatus by use of the modified impact ball thrust method. Smithers Laboratories will supply blueprints to those who do not purchase the kit from Scott Testers.

W. A. Frye, Inland Mfg. Division, General Motors Corp. submitted data to show that push-button operation of the solenoid tester could be reduced by the use of a timing relay and also suggested the use of Thyraton tube firing. Messrs. Frye and Ofner were requested to develop, if possible, a method of firing the solenoid at specific points on the 60-cycle sine wave to determine its influence on velocity.

Also, in connection with D 746-57T, "Tests for Brittleness Temperature of Plastics and Elastomers," the chairman of subcommittee 25 was authorized to request Committee D-20 to modify the method to allow the use of gravity or other actuation provided the speed and other requirements of the test are met. The chairman was authorized also to request D-20 to allow the use of the narrow straight sided specimen as an alternate, and to request ISO/TC 45 (Sec. 250) Document 389 to allow the use of the modified T 50 specimen as an alternate, which would bring D 746-57T and the ISO/TC 45 methods into agreement.

F. Conant, Firestone, reported that the Scott solenoid tester meets the 6-7 ft./sec. velocity requirements and operated satisfactorily when operated on 85 volts.

It was decided that 95% confidence limits which would be narrow enough to be of value could not be established for D 746-57T because of the wide spread in brittle temperature characteristics of certain compounds.

W. H. Bryan, Du Pont, will head a task group to investigate the development of a method of test for the low temperature properties of coated fabrics, as requested by subcommittee 24 on Coated Fabrics.

Subcommittee 26—Processibility. R. H. Taylor, Scott Testers, chairman. Ross Shearer, Goodrich, chairman of the task group working on the revision and combination of D 927-57T, "Test for Viscosity of Rubber and Rubber-Like Materials by the Shearing Disk Viscometer," and D 1077-55T, "Test for Curing Characteristics of Vulcanizable Rubber Mixtures during heating by the Shearing Disk Viscometer," presented a report. Several changes in this report were agreed upon, but before these changes are made, the report will be circulated to all members of the subcommittee for comments. Another draft of the report will then be prepared for the June, 1959, meeting.

J. F. Kerscher, Goodyear, chairman of the task group on the standardization of extrusion test dies and methods, reported that several different dies are being used. Definite recommendations for the proper die and its use are planned for the June meeting.

F. J. Sackfield, American Synthetic Rubber Corp., chairman of the task group on shrinkage tests, reported that a method for use with raw polymers has been developed, and work is being done on a method for compounded polymers. The two methods will be included under one designation, and a final report is expected in June, 1959.

A. E. Juve, Goodrich, reported that the information on the Kanavets shear plastometer indicates that it could not be recommended for use in this country. The alleged superiority of this instrument appears to be based on a comparision with poor data obtained with the Mooney viscometer.

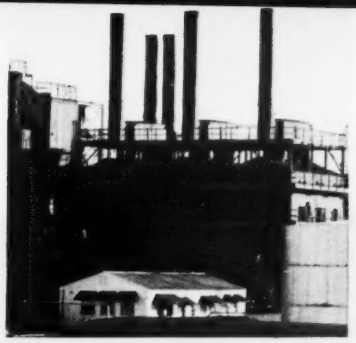
Subcommittee 27—Resilience. W. A. Frye, Inland Mfg. Division, General Motors, chairman. Three negative votes received on the subcommittee letter-ballot in connection with the proposal to change the method of computing resilience in D 945-55, "Methods of Test for Mechanical Properties of Elastomeric Vulcanizates under Compressive or Shear Strains by the Mechanical Oscillograph," were resolved, and the revised proposal is recommended for letter-ballot in Committee D-11.

Data presented indicated that variations in pen pressure do not significantly influence results in D 945-55; however, the subcommittee chairman was authorized to contact laboratories using the method to determine if they want to run a cross-check to determine the extent of inter-laboratory agreement.

Interest in a general method of force vibration testing is such that a task group consisting of the chairman and the secretary of subcommittee 27 will draft a proposed method of test along these lines.

The jurisdiction of D 623-58, "Test for Compression Fatigue of Vulcanized Rubber," has been assigned to subcommittee 27.

Subcommittee 29—Compounding Ingredients. A. E. Juve, Goodrich Research Center, chairman. The task group headed by G. C. Maassen, R. T. Vanderbilt Co., which has been working on rewriting D 15-58T, "Methods of Sample Preparation for Physical Testing of Rubber Products," the incorporation of D 1522-58T, "Methods for Testing of Carbon Black in Rubber," and the reorganization of all of this material, reported that although progress has been made, a number of items cannot be finalized at present, pending the finding of other groups working on certain aspects of these methods. If possible, the final revision will be prepared in time for the June, 1959, meeting and for letter-balloting in the subcommittee.



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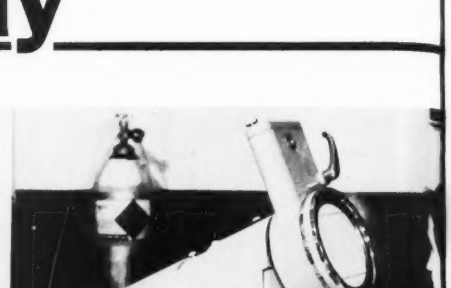

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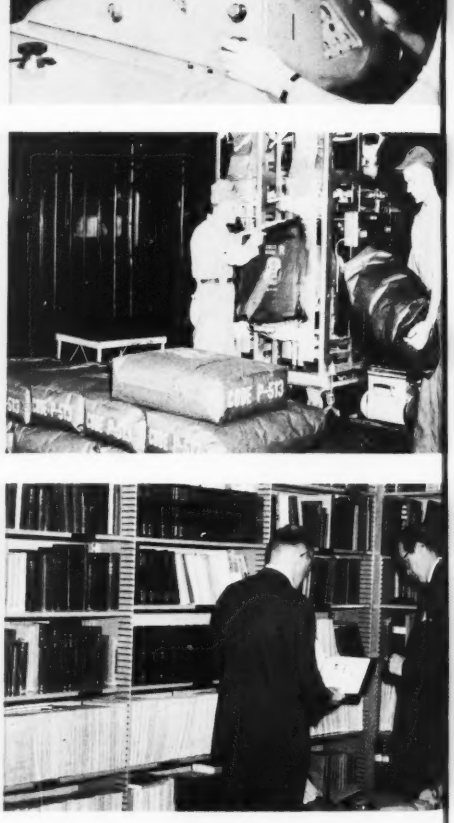

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R. M. Vance, Columbian Carbon Co., reported the work of his task group which has been investigating the suitability of the mixing procedures now specified in D 1522-58T. Mill mixing procedures have been found adequate for all grades of black. The Banbury mix procedure of a nine-minute cycle followed by an 8½-minute finish mill mix has been replaced by a six-minute cycle in which sulfur and accelerator are added in the Banbury after comparison tests which demonstrated no sacrifice in reliability by this change. The shorter mixing cycle did result, however, in shorter scorch times and higher modulus of the various stocks tested.

Several suggestions for changes in the procedures for testing carbon black were made by a group representing the carbon black producers, as follows: (1) the use of a single test recipe for all types of carbon black; (2) the use of 50 PHR of black for all grades of black except FT and MT; (3) the use of two curing times only; (4) the establishment of a 300,000-pound reference lot of black to be available to all producers and consumers.

The chairman of subcommittee 29 was authorized to appoint a task group to consult with the producer of the reference lot of carbon black and aid in setting up a sampling plan and testing procedures for checking the uniformity of the lot and for considering the effects which storage conditions may have on the stability of the properties of this reference lot of carbon black.

Another task group will be formed to consider the merits and provide the supporting data for the first three recommendations of the industry group.

It was agreed that recipe 2A in D 15-58T should be modified by increasing the stearic acid content from one to two parts.

SAE-ASTM Technical Committee A

H. Tanenberg, Goodrich, secretary of the SAE-ASTM Technical Committee on Automotive Rubber reported that the following items have been approved by letter-ballot in the Technical Committee: Specifications and Methods of Test by Polyvinyl Chloride Foams; Methods of Test on Urethane Foams; Specifications and Methods of Test on Automotive Air Conditioning Hose; Radial Seal Nomenclature; Fuel C; and an addition to the Automotive Gasket Materials Specification ASTM D 1170-57T. A letter-ballot on the addition of tear values to D 735-58T received negative votes and was returned to the subsection.

Items now being letter-balloted in Tech A include the following changes in D 735-58T: Replacement of D 736-54T, "Test for Low Temperature Brittleness of Rubber and Rubber-like Materials," by D 746-57T, "Test for Brittleness Temperature of Plastics and Elastomers by Impact," for evaluations for the F suffix; the use of D 1053-58T, "Method of Measuring the Low Temperature Stiffening of Rubber and Rubber-Like Materials by Means of a Torsional Wire Apparatus," using a 10,000-psi. maximum modulus, for evaluations for suffix S; the addition of a TA-512 silicone rubber grade to Table V of D 735-58T; reduction of the time for the compression set test from 70 to 22 hours and the new values resulting.

K. J. Miller, Molded Rubber Specialties, Inc., is chairman of the newly organized Section XV on Suspension Bushings; Section XIII on Standardization with Reference to Flash on Molded Goods has been made inactive since its recommendations are incorporated in the SAE Drafting Standards; Section X on Gaskets has been reorganized with M. H. Kapps as chairman; R. C. Waters is chairman of Section XI, which includes subsection A on O-rings and B on oil seals.

The following subsections have been added to Section IV on Automotive Rubber Compounds: D-5 on Hypalon, chairman, J. P. Mann; D-6 on Polyurethanes, chairman, H. H. Anderson; D-7 on Fluorocarbons, D. S. Messenger, chairman; and Z on Stress Relaxation, P. Weiss, chairman.

Activity continues in all other sections of Tech A, with considerable progress reported in connection with the work on coolant, wire braided and power steering hose; gaskets and automotive mats.

Section IV under H. A. Winkelmann continues to expand its efforts in connection with developing information on new polymers and new tests for use in D 735-58T. Subsection IV D on Tables, headed by N. L. Catton, continues its work on the development of the new and expanded tabular system for the classification of rubber compounds.

N. Y. Section, SPE, Vinyl Subgroup Meets

The New York Section of the Society of Plastics Engineers, Inc., held its first meeting of 1959 on February 18 at the Governor Clinton Hotel, New York, N. Y., with approximately 200 in attendance. In addition to the regular meeting of the section, a newly formed Vinyl Professional Activities Committee (VIPAC), met and introduced its officers and the two speakers on vinyls for the evening. These speakers were James L. Huston, The General Tire & Rubber Co., who spoke on "Characterization of Vinyl Resin by Viscosity"; and R. Braddicks, Kentile, Inc., who chose "Improved Classification of Vinyl Resins" for his topic. Summaries of these talks follow.

Mr. Huston, in discussing the techniques by which polyvinyl chloride processors can determine the molecular weights of PVC resins and thereby select the proper resin for specific processing, indicated that an absolute molecular weight determination is time-consuming and complicated. He reviewed a simplified approach in the form of dilute solution viscosity in as much as intrinsic viscosity characterizes the resins accurately on a relative basis. The relation of the various molecular weight resins to the ultimate resin properties was explained in detail. He indicated that the need of selection and control of processing temperatures in combination with each resin viscosity is paramount in order to achieve the maximum processing advantage. In the final summary, he stated, the selection of the resin by intrinsic viscosity index, and in turn the choice of the optimum processing conditions, must be related in order to achieve the optimum product results.

Mr. Braddicks, while appraising the value of solution viscosity techniques, felt that they were of greater value to the supplier of vinyl resins than to the user. The user is less fortunate than his supplier owing to the extreme lack of consistency in presentation of data among resin producers. Various producers prefer various types of viscosity calculations for presenting characterization data on their resins. As a supplement to dilute solution viscosity techniques for the processor, Mr. Braddicks recommended that resin manufacturers give serious consideration to the inclusion of high-temperature flow data in their product specifications since several commercially available instruments are suitable for determining flow data of molten vinyl polymers. He also recommended that these data be provided in terms of an agreed-upon standard procedure.

This speaker also showed that ease of processing or softness of resin is conveniently ascertained without the complications of variable solvents and concentration effects or changing polymer type which are inherent in dilute solution viscosity techniques. Three commercially available instruments are suitable for this purpose: (1) the Brabender plastograph, (2) the Tinius Olsen parallel plate plastomer, and (3) the Mooney viscometer. The parallel plate plastometer offers the advantage of furnishing flow data in terms of the fundamental poise unit. On the other hand, the Brabender and Mooney plastometers offer data obtained under dynamic rather than static test conditions. These dynamic data for viscoelastic materials, Braddicks concluded, can provide an advantage of more closely simulating behavior typical of that expected during processing as well as data on heat stability comparisons of resin equivalents. The onset of degradation of these resins is detected by an abrupt rise in the power-time curve, the speaker added.

Chicago Group Panel Tries To Explain SBR Industry Problems

The technical session was devoted to the past, present, and future of the SBR (styrene-butadiene) synthetic rubber industry at the Chicago Rubber Group meeting, January 30. Subjects of the four papers presented covered hot and cold SBRs, oil-extended rubbers, black masterbatches, and some new elastomers. Harold George, American Synthetic, gave a breakdown of most of the current hot and cold SBRs, with a brief description of the differences and some of the typical uses for the various grades. Paul G. Carpenter, Copolymer, presented the rundown on the oil-extended masterbatches. His talk was quite complete in covering the history, production methods, oils used, and some of the problems of production and of use of the oil-extended grades of SBR.

A. G. Susie, United Rubber & Chemical, provided the Group with an excellent summary of the black masterbatch picture at the present time. The revival of this SBR type with new producers entering the field every year made this talk of very great interest. Dr. Susie sounded a warning to producers and consumers alike on the number of variations being made and the implications thereof and made a plea for agreement on types and nomenclature. (Note: Subcommittee 13 of ASTM Committee D-11 has recommended for letter-ballet to the membership that masterbatches having less than 14% oil would not be considered as being oil-extended black masterbatches, but merely be classified in the black masterbatch types. Those containing more than 14% would be classified as oil-black masterbatches.)

W. B. Reynolds, Phillips, brought the session to its conclusion on a very bright note for the future with a paper on some recent development in the synthetic rubber field. Using polybutadiene as his example he proposed that the better points of this elastomer and of others to be made by stereospecific catalysts put the industry on the threshold of an interesting and exciting new era of synthetic rubber technology.

A. E. Laurence, Phillips Chemical Co., Akron, O., was moderator for the panel session, which took place prior to the dinner-meeting of the Group. More than 200 members and guests attended the meeting, held at the Furniture Mart in Chicago, Ill. Following dinner the Group was entertained by a barber-shop quartet, "The Drifters."

Technical Session Summary

"Hot and Cold Rubbers," by Harold George, American Synthetic Rubber Corp., New York, N. Y., provided a quick look at many of the commercially available styrene-butadiene (SBR) rubbers of both the hot and the cold type, with a brief description of the differences and what typical uses are for the different grades.

The paper was divided into two parts, with the first covering the older hot grades which the author classes as being 76.5 parts butadiene and 23.5 parts styrene and polymerized at 122° F. This classification covered 13 commonly known types of hot rubber and was listed as the grades are listed in ASTM D 1419-58T, "Description of Types of Styrene-Butadiene Rubbers."

The second part of Mr. George's talk presented information on the cold rubbers. He gave similar descriptions for nine of the cold rubbers, some of which were the older cold rubbers, and a few of which were some of the newer cold rubbers. In these cold rubbers, the listing followed that of the ASTM designations, but was not so complete a list as that presented for the hot grades. He did indicate that the cold rubbers of today are as easy processing as the hot rubbers, and this fact led him to wonder why there was still such a high usage of the hot types particularly since the cold types seem to offer advantages in improved physical properties.

"Oil-Extended Rubbers" by Paul G. Carpenter, Copolymer Rubber & Chemical Co., Baton Rouge, La., provided the Group with a very good and very complete story on OER. Dr. Carpenter drew on his experience for some generally unknown facts to provide a very understandable explanation for some of the problems and growing pains of the oil-extended SBRs.

Oil-extended rubber began its real inroads into the SBR picture in 1952, which was the first full year of production of OER. In 1952, 59,000 long tons, or 24%, of the cold SBR production was oil-extended rubber. In 1958 this figure increased to 310,000 long tons, or 50%. The figures (in long tons) for the years 1952 through 1958 appear in Table 1.

The obvious driving force, according to Dr. Carpenter, for this growth has been economic. Taking a 24.1¢-per-pound rubber and diluting it with 2¢ oil gives masterbatch costs of 20.4¢ with 25 parts oil, 18.9¢ with 37½ parts oil, and 17.3¢ for 50 parts oil. With this oil considered part of the rubber and using higher black loadings, even further savings are made on compound costs.

In order to use oil for extending SBR rubbers it is necessary to produce a high Mooney polymer which is then lowered in viscosity by the diluting oil. As examples, regular SBR polymers have 50 Mooney and average molecular weight about 70,000. For a 25-part oil masterbatch a polymer of 110 Mooney and about 175,000 molecular weight must be used. A 37½-part masterbatch requires a 130 Mooney and correspondingly higher molecular weight.

TABLE 1

Year	Oil-Extended Rubber (1,000 Long Tons)	Gross Non-Black Cold Rubber (1,000 Long Tons)	% Oil-Extended Rubber
1952	59	247	24
1953	137	362	38
1954	142	284	50
1955	224	419	54
1956	256	614	*42
1957	324	689	*47
1958	310	618	50

*The author himself indicates some doubt about these figures.

Dr. Carpenter was very emphatic in stating, "You cannot achieve the advantages of oil extension by the mere addition of oil to SBR 1500 or 1502."

With some stability difficulties in the early oil-extended SBR and to aid the search for light-colored polymers a simple stability test was devised as follows: The rubber is placed into an air oven for a period such as seven hours at 100° C. and then examined visually. The differences are remarkable between different rubbers and with different oils. The newer non-staining antioxidants with sufficient potency have allowed the production of light-colored oil-extended SBR as stable as the staining varieties.

Along with the search for non-staining antioxidants, the need of a light-colored oil was felt for the production of the light-colored oil-extended SBR, which has led to the incorporation of naphthenic oils of light color rather than the darker aromatic oils. Most of the production is still of the dark staining-type rubbers, but increasing amounts of the light-colored material are being used in automotive and other mechanical goods.

One compounding problem which still has adherents on both sides is the problem of assigning a hydrocarbon content on these rubbers. Some compounders prefer to use 100 parts of oil-extended rubber as all-rubber; while some use only the actual polymer portion. For all practical purposes, the compounding is simplified by using the oil as part of the polymer and basing the recipes on 100 parts of actual polymer plus oil. Adjustment of curatives will probably have to be made, however.

While tires use great quantities of

the oil-extended SBRs, almost every type of SBR rubber product has also been made or tried with oil-extended SBR substituted for regular SBR.

"Black Masterbatches," by A. G. Susie, United Rubber & Chemical Co., Charleston, W. Va., was a report on the status of the black masterbatch industry. While black masterbatches are not really a new item in the rubber field, they are having a rebirth, so to speak, after some rather lean years. Dr. Susie predicted that black masterbatches could become the fastest growing category of SBR production.

This renewed interest is the result of an awareness of the economic advantages inherent in these products for the consumer in materials handling, conversion cost reductions, and in mixing capacity with no loss of quality. Recent reports by Braendle[1] and his coworkers[2] indicate superior-quality black masterbatches can be made by certain improvements in the process and have added to this up-swing in masterbatch production by seven SBR producers, with three more having experimental work under way or reported as being interested.

The number of black masterbatches offered or in experimental stage, as reported by Dr. Susie, are as follows (December, 1958):

TABLE 2

Company	Commercial	Experimental
American Synthetic Rubber Co.	none	none
Copolymer Rubber & Chemical Co.	6	4
Firestone Tire & Rubber Co.	none	none
General Tire & Rubber Co.	1	3
Goodrich-Gulf Chemical Co., Inc.	9	none
Goodyear Synthetic Rubber Corp.	none	yes
Phillips Chemical Co.	6	10
Shell Chemical Co.	13	none
Texas-U.S. Chemical Co.	3	
United Rubber & Chemical Co.	24	none
United States Rubber Co.	none	none

The detailed statistics for the production of the various types of black masterbatches (regular cold, regular hot, and cold oil-extended types) for the years 1951-1958 inclusive, are shown in Tables 3, 4, and 5.

The production data for the black masterbatches in Table 3 show the decline almost to the vanishing point of hot black masterbatch as a major commercial item. In 1951, it comprised 42.6% of the total masterbatch production, but by 1958 it had dropped to less than 1%. Conversely, there is a definite trend upward in the production of oil-extended black masterbatches, from 10.8% in 1951 to 59% in 1958. This rise parallels the increase in prominence of the oil-extended masterbatches in the non-pigmented field.

[1] RUBBER WORLD, Sept., 1957, p. 835.
[2] Ibid., Sept., 1958, p. 869.

TABLE 3. BLACK AND OIL-BLACK MASTERBATCH PRODUCTION, 1951-58

(In Long Tons)

Period	Producers	Carbon Black Masterbatches: Cold	(%)	Hot	(%)	Oil Black Masterbatches: Cold	(%)	Total
1951	4	58,294	(46.6)	53,279	(42.6)	13,431	(10.8)	125,004
1952	4	74,038	(55.8)	42,390	(32.0)	16,189	(12.2)	132,617
1953	3	73,050	(61.3)	21,290	(17.9)	24,821	(20.8)	119,161
1954	3	48,372	(62.0)	6,294	(8.1)	23,335	(29.9)	78,001
1955	3	60,175	(59.4)	6,447	(6.4)	34,574	(34.2)	101,196
1956	3	68,649	(70.3)	2,538	(2.6)	26,396	(27.1)	97,583
1957	5	54,977	(60.5)	3,195	(3.5)	32,725	(36.0)	90,897
1958 (11 mos.)	7	46,913	(40.2)	1,042	(0.9)	68,753	(58.9)	116,708

SOURCE: Rubber Manufacturers Association's Statistics of Synthetic Rubber Industry.

The production of black masterbatch types *versus* total SBR production for the period 1951-1958 is shown in Table 4. Data are given on a net polymer basis (oil-free, carbon black-free) and on a gross product basis (including oil and carbon black), comparing, respectively, the polymerization capacities used and the actual gross production. The data in Table 3 reveal that between 7% and 14% of the polymerization capacity of the various plants were used in the manufacture of black masterbatch types during this period, and this produced between 10 and 20% of the finished product output.

In Table 5 the percentage distribution of black masterbatch types production by companies is shown for the period May, 1955-December, 1957. The three major producers in this table, United Rubber, Phillips, and Shell, were joined in 1957 by Texas-U.S. and Goodrich-Gulf and will be joined in the 1958 listings by Copolymer Corp. and General Tire. The expected entry in the field of some of the other big producers of SBR will probably cause a realinement in the rank of the companies as black masterbatch producers.

One of the problems encountered by black masterbatches, as they were first introduced, was a question of quality. Particularly in the Braendle process the lack of reproducibility in the products caused the government to drop the investigation of this-type process during the period of government ownership of the copolymer plants and favor the conventional process in which the micropulverized black is dispersed in water, mixed with latex, and then coagulated with salt/acid. The Braendle process disperses the black in water with violent mechanical shear, mixes it with latex, and coagulates with acid.

There is also an intermediate process which combines the best features of both the Braendle and conventional processes. Today's black masterbatches, prepared by any method, are at least equivalent in quality to the corresponding dry mixes, and some of the proponents of these processes claim spectacular improvements.

In a road test of tires made from an oil masterbatch made by the conventional method and from a dry mix control using identical recipes, the masterbatch produced treads equivalent to the dry mix treads on the average. Twenty half-and-half tires were tested in five groups of four, and the road wear ratings of the masterbatch tread ranged from 95 to 105% of the control.

The variety of compositions possible in black masterbatch manufacture has intrigued the compounder to the extent that each feels a need of a tailor-made product for his process. Indeed, this often differs between compounders for the same application. As a result, the list of masterbatch types expands,

TABLE 4. BLACK AND OIL-BLACK MASTERBATCH PRODUCTION *versus* TOTAL PRODUCTION

Year	Net SBR Content*: Black Masterbatches	Total Polymer	%	Gross SBR Production†: Black Masterbatches	Total Production	%
1951	81,357	694,583	11.7	125,004	742,031	16.8
1952	86,793	621,867	14.0	132,617	680,400	19.5
1953	77,355	631,696	12.2	119,161	706,491	16.9
1954	50,141	432,782	11.6	78,001	496,821	15.7
1955	64,383	727,037	8.9	101,196	822,391	12.3
1956	62,768	802,834	7.8	97,583	902,259	10.8
1957	57,389	820,921	7.0	90,897	938,405	9.7
1958 (11 mos.)	69,542	698,701	10.0	116,708	822,838	14.2

*Does not include oil or black content.
†Includes oil and black content.
SOURCE: RMA Statistics.

TABLE 5. % DISTRIBUTION OF BLACK MASTERBATCH PRODUCTION

	% of Black Masterbatch Produced					
	May-Dec., 1955		1956		1957	
Company*	Regular†	Oil‡	Regular†	Oil‡	Regular†	Oil‡
United Rubber (8)	51.1	77.3	58.6	77.6	60.6	70.9
Phillips (6)	39.0	13.6	28.8	21.9	26.9	21.8
Shell (5)	9.9	9.1	12.6	0.5	11.4	7.3
Texas-U.S. (4)					0.9	
Goodrich-Gulf (2)					0.2	
Total	100.0	100.0	100.0	100.0	100.0	100.0

*Number in parentheses following company name identifies the rank in order of total SBR polymer capacity, 1957.
†Regular black masterbatches include cold and hot types.
‡Oil-black masterbatches.
SOURCE: "Third Report of the Attorney General on Competition in the Synthetic Rubber Industry, July 1, 1958."

some with only slight modifications, but another product just the same, which imposes a handicap on the producer. It would be highly desirable to have fewer masterbatches of wider composition differences and let the compounder arrive at his particular composition by blending appropriate types.

The producer also may, in trying to satisfy the wants of his customer, produce types which cannot be adequately described in terms of the standard unpigmented polymer. This state of affairs has led to confusion in some cases. Dr. Susie suggested that it would be well for the producers to standardize on types and on nomenclature. ASTM has made an effort in this area, and he felt that the problem should be investigated further.

Among his conclusions Dr. Susie said, "The number of minor variations in the present black masterbatch types, and their implications, serve as a warning to the producers and the consumers for the need of standardization in nomenclature and types."

"Recent Synthetic Rubber Developments," by W. B. Reynolds, Phillips Chemical Co., Akron, used a description of the polybutadiene elastomers to explain the stereospecific elastomers generally.

Considerable interest has been generated throughout the industry by the new elastomers produced with these stereospecific catalysts. The "synthetic natural rubbers" fall into this class as do the polybutadienes described in this paper.

Some of the catalysts being used are: (1) chromium oxide on silica-alumina; (2) molybdena on alumina; (3) complex of trialkyl aluminum and $TiCl_4$; (4) complex of trialkyl aluminum and $TiCl_3$; (5) metal hydrides plus titanium halides; (6) sodium plus $AlCl_3$ plus titanium halides; and (7) lithium.

Polybutadiene produced by emulsion methods gives a mixture of four forms, a *cis*, a *trans* form, and two vinyl forms. By using the appropriate stereospecific catalyst an elastomer of desired proportions of one or more of these forms can be produced. The form which has aroused the greatest interest in the polybutadienes is the *cis* form This form acts the most like natural rubber, and although it cannot really be classed as a synthetic natural since it is not isoprene based, it can be substituted for natural rubber in many uses. Because of the processing difficulties it cannot be used 100% in a stock such as tread stock. Blends of *cis* polybutadiene and a natural rubber, however, work very well.

The *trans* is very hard, crystalline, and more like gutta percha; the high vinyl elastomers are interesting as low hysteresis elastomers, and an 80% *cis* elastomer is outstanding as an "Arctic" rubber. The development of these forms is expected to provide many new and novel possibilities for elastomers.

Questions and Answers

Q. Can equivalent physical properties be obtained by substituting a carbon black SBR masterbatch for the same amount of SBR and carbon black?

A. Susie. Yes. Our tests indicate there is no difference in physical properties.

Q. What SBR polymer is recommended for hard rubber?

A. George. Generally 1004 and 1503 are used although some 1019 is favored because of its low moisture content.

Q. What SBR polymer is recommended for taste and odor-free food applications?

A. George. Most of the SBR grades are satisfactory for taste and odor-free applications. For best results one should select his compounding ingredients with care.

A. Reynolds. We should call attention to the recent changes in the Food & Drug Law which sets up more restrictive requirements for all materials to be used in packaging foods. Anyone working in this field should be careful to investigate the details of the new law.

Q. What percentage moisture is present in SBR carbon black masterbatches?

A. Susie. All masterbatches are very low in moisture content. The specifications read 1% maximum, but the actual moisture content is much lower —about 0.3 to 0.5%.

Q. What has been done to reduce the number of SBR polymers?

A. Carpenter. This is a difficult problem for most producers. Many of the polymers differ only slightly, and it is questionable whether slight changes in composition are necessary. Particularly in the case of the SBR carbon black masterbatches there are some which differ only by 3% to 5% in the amount of black present. This hardly seems desirable, and it would seem to be to the advantage of consumer and producer alike to cut down on the number of different masterbatches made.

Q. What role will natural rubber play in the future?

A. Reynolds. Natural rubber will continue to be important for the indefinite future; however, with the advent of the new low hysteresis-type synthetics such as *cis*-polyisoprene and *cis*-polybutadiene, it is probable that natural rubber will not fluctuate so greatly in price. These new elastomers place an effective ceiling on the price of natural rubber because if it goes too high, it will become profitable to make these new polymers. It may be expected that the demand for natural rubber will exceed the supply in the next ten years, and when and if this happens, the new elastomers will become of vital importance.

Q. What can be done to produce pure SBR elastomers?

A. Carpenter. So long as we are using emulsion polymerization a certain amount of emulsifying agents and other chemicals is always going to be present. However, if anyone has any ideas on new, purer SBR polymers, we will be glad to make them provided sufficient volume is ordered.

Q. Is anything being done to improve the inherent poor hot tear resistance of SBR polymers?

A. Reynolds. Hot tear is a characteristic deficiency of SBR. Some improvement may be obtained by careful compounding. It may be expected that the current research on the new stereospecific polymers will offer definite improvement of this property, and eventually a completely satisfactory polymer will be developed.

Q. RUBBER WORLD has offered to publish information on numbers, composition, and prices of the experimental and semi-commercial SBR polymers. Do you think such a summary would be of value to the industry?

A. Susie. Such a tabulation should be of value to the producers as well as the consumers of SBR elastomers. In compiling information for this presentation we found there was considerable lack of information on the different types of experimental SBR polymers available; therefore anything that can be done to clear up this situation will be a service to the industry.

Halobutyl, Urethane, FluoroC, and Synthetic NR Topics for Akron RG

Six excellent papers on new advances and developments of halogenated butyl, polyurethanes, fluorocarbons, and the *cis*-polyisoprenes and polybutadienes were delivered in a "New Elastomer" symposium before the Akron Rubber Group January meeting. There were two papers on halogenated butyl, two on the "synthetic naturals," and one each on the polyurethane and fluorocarbons.

R. T. Morrissey gave the latest thinking of the Goodrich research group on the halobutyl. Goodrich has had a bromobutyl on the market, and some of the features of this elastomer and other work in this field were given in this talk. To add to this knowledge, L. T. Eby followed with a presentation of some practical applications and limitations of the halobutyls found by the Enjay market development group. Enjay has a chlorobutyl elastomer, MD-551, and the better features of this material along with the information on the bromobutyl elastomers were discussed.

General Tires' experiences with Genthane-S polyurethane were reported by O. Keplinger. Some of the background was given on the rise of the polyurethanes along with much test data and formulations for the use of these elastomers.

The fluorocarbon elastomers were represented at the symposium by H. H. Abernathy, of Du Pont. His paper explained briefly the entire field and listed the many new entries in this growing market. Most of the formulations and illustrations presented, however, were based upon the polymer familiar to the author, the Vitons. Part of the talk was devoted to the announcement and explanation of a new latex-type Viton, to be put on the market soon.

W. M. Saltman, for Goodyear, and Glen Alliger, for Firestone, gave the meeting some inside information on the new *cis*-polyisoprenes and *cis*-polybutadiene. While these elastomers are not yet in commercial production, these authors recounted some of the problems faced in making them and indicated how the development of these rubbers may help offset the predicted shortage of natural rubber in the future and how the basic chemistry involved may some day produce "Tailor-made" polymers by the use of stereospecific catalysts. They indicated that the economics of these elastomers may not be as far out of line as some previous reports seem to think.

The Dinner Program

These above-mentioned papers were presented at the afternoon technical session of the Akron Rubber Group held in the Sheraton Hotel, Akron, O., on January 23, with 625 attending. After the session the group held the usual social hour and then dinner at 6:45 p.m. The dinner-speaker was Kenneth McFarland, educational consultant for General Motors Corp., Detroit, Mich., who spoke on "Three Dimensional Confidence", the theme of which was that the never-ceasing desire to learn will forge a successful path for the future.

"New Elastomers"

The technical session was moderated by J. R. Davis, E. I. du Pont de Nemours & Co. Abstracts of the papers are given below.

"Halogenation of Butyl Rubber" by Richard T. Morrissey, The B. F. Goodrich Co. Research Center, Brecksville, O. This report gave the results of actual experience on how the halogenated (particularly brominated) butyl polymers overcome certain features of butyl which have been recognized as needing improvement. The three main properties in which improvement might be obtained are, a faster rate of cure, the development of a satisfactory cure in mixtures with natural and other synthetic rubbers, and adhesion to other rubbers and metals. The second point involving the mixtures of butyl and natural or synthetic has been widely sought to help avoid the problem of contamination existing in plants using butyl stocks.

The halogenated polymers were actually discovered in the search for means of improving these properties in the original elastomer. It was discovered that 1.0-3.5% by weight of bromine along the butyl chain increased the cure rate without degrading other properties. It is considered that this addition is made on the 2-3 parts of isoprene in the isobutylene-isoprene copolymer. With only a part of the isoprene units thus saturated, the remaining isoprene is still available for sulfur cure; while curing through the halogen can be accomplished with a bivalent metal oxide. The durability of these two methods of cure results in the faster cure rate for halogenated butyl.

The halogenation also produces greatly improved cured properties in blends of bromobutyls or chlorobutyls with unsaturated rubbers, such as natural rubber. While there is a slight drop in tensile strength with the increase of bromobutyl in the mixture, it does level off at a respectable tensile value. The choice of curing ingredient may have some bearing on the amount of decrease in tensile and permit some of this drop to be eliminated.

One interesting point in the study is the effect of the amount of the halogen in the butyl elastomer in a 70/30 mixture of halogenated butyl and natural rubber. It was found that 1.0-1.2 grams of chlorine or 2.5-3.0 grams of bromine per 100 grams of the combined polymers would produce optimum tensile properties.

The low air diffusion properties of butyl may be utilized in blends of brominated butyl and natural rubber

General Tire Photo

"New Elastomer" symposium panel at the Akron Rubber Group meeting: *(left to right, standing):* R. T. Morrissey, L. T. Eby, and O. Keplinger; *(sitting):* H. H. Abernathy, W. M. Saltman, G. Alliger, and J. R. Davis

or SBR. The diffusion rate decreases linearly with increasing amounts of butyl up to a 50-50 ratio. The ozone resistance of the blends with natural rubber and SBR may be improved in much the same order of magnitude as the air diffusion rate.

The third desirable improvement in butyl listed above was better adhesion to other rubber and to metal. It has been found that this property is also greatly enhanced by the brominated butyl. In a test using brass inserts and a resorcinol-formaldehyde resin followed by the brominated butyl cement, the adhesion of butyl to natural rubber or brass showed a marked improvement both at room temperature and at 212° F.

It has been found therefore that desirable properties may be produced by the halogenation of butyl rubber. Bromine seems to be the best all-around halogen for use at this time. Chlorine also can be used but it is not quite so satisfactory for most uses as bromine. Iodine reacts so slowly that it is not of too much use, and fluorine reacts too fast and breaks down some of the butyl chains and reduces molecular weight. Halogen halides such as iodine monochloride also may be used, and this particular one gives polymers with properties close to those of the brominated polymer, but at present the use of ICI is not economically feasible.

"Practical Applications of Halogen-Containing Butyl Polymers," by L. T. Eby, Enjay Co., Inc., Elizabeth, N. J. was a discussion of some of the uses and projected uses of the halogenated butyls. This author classes bromobutyl as a specialty rubber, but suggests it may or may not remain in that classification. Chlorobutyl, on the other hand, he feels will get into the general-purpose class of elastomers. He also lists compatibility with other rubbers as a prime plus property for the halobutyls since this property allows the use of bromobutyl in the inner liner in an SBR tubeless tire to give the air holding power of the butyl, but the adhesion and compatibility of natural rubber or SBR. It also permits the use of this good adhesive polymer in cements or tie ply coats between two other elastomers.

In chlorobutyl the chlorine atom promotes an interaction between the polymer and carbon black which allows lower processing temperatures and less mixing time to obtain optimum dynamic properties. This promoting will also be of benefit in blends of small amounts of chlorobutyl in regular butyl stocks for heat treatment or polymer pigment interaction of the butyl compound.

A cure system, when used in blends, must be chosen which will be effective in the other elastomer as well as the butyl, which often means that a sulfur cure will be used. Adjustments may be made, however, to obtain optimum performance. One problem faced with these polymers is a tendency to scorch. The bromobutyl is more liable to scorch than the chlorobutyl, and the cure rates of the bromobutyl are thus usually faster than the chlorobutyl. The polymethylolphenol resin cures differ in halobutyl from the action in regular butyl in that the reaction is rapid and direct and requires no halogen activator. Short cures produce vulcanizates with excellent dynamic properties and low set.

Some chlorobutyl compounds are outstanding in performance at elevated temperatures. They retain good physical properties after aging, but also have good properties at the elevated temperature. Elongations will depend upon the type of cure, with the resin cures shorter than the zinc oxide-thiuram cures although the set properties of the former are superior.

Ozone resistance is best in resin cured stocks of chlorobutyl. The zinc oxide-thiuram cures are next best in resisting ozone, with the sulfur cures being the least resistant. Magnesia may be used to retard scorch and improve high-temperature aging, but must be used with a thiazole derivative or used sparingly in a zinc oxide-thiuram cure. Small amounts can be used in sulfur cures, but magnesia should not be used in resin cures unless a highly calcined inactive type is employed.

"Polyurethanes," by O. Keplinger, The General Tire & Rubber Co., Akron, traced some of the early developments in polyurethanes from the date of the first report by Wurtz in 1848 of the basic reaction between an alcohol and an isocyanate to form a urethane. The first polymer was prepared in 1937 by Otto Bayer, of I. G. Farben, and other rubber-like polymers were also made in Germany about the same time. These were cast urethanes. The first millable polyurethane was made in England and called Vulcaprene. Following this, Goodyear, Du Pont, and General Tire produced millable polyurethanes in this country. At present Du Pont's polyetherurethane, Adiprene-C, and General Tire's polyesterurethane, Genthane-S, are available as millable gums. Both can be cured with peroxides and polyisocyanates. The Adiprene-C may also be sulfur cured.

When isocyanates are used for curing, the stocks are scorchy and crosslink at room temperature in days or sometimes even in hours. They are only partially cured in the molding operation even so, however, and are difficult to remove from the mold. They then require several days of after-cure in contact with a humid environment. The use of peroxide cures has introduced a new order of processibility to the industry. Such compounds are quite stable at temperatures below 250° F. and can be milled, calendered, extruded, or preformed by normal factory procedures. They are fully cured in the mold and can be cured in 20 minutes at 320° F. They can be cured in any way except open steam, which destroys the rubber.

The cast polyurethanes are degraded by fillers, but the millable polymers require fillers for reinforcing properties. Fine particle blacks are preferred, with the best balance of properties being with low loadings of top-grade blacks. A full range of colored stocks is possible using HiSil 233 (precipitated hydrated silica) for reinforcement. The quality is slightly lower than that of black stocks, but color retention and resistance to ultra-violet light are excellent.

Low-temperature properties of polyurethane elastomers are not outstanding, but further work is being done to try to improve this defect. Thermal degradation is a problem with urethanes, but in some experimental urethanes a new magnitude of resistance has been demonstrated. In contrast to NBR stocks the resistance of the urethanes was better in air aging than in oil which was good, however.

"Fluorocarbon Elastomers — The Vitons," by H. H. Abernathy, Du Pont, Wilmington, Del., was a description of the fluorocarbons in general expressed in terms of the Vitons in particular, which are more familiar to the author. The paper contained a listing of the common types and grades of fluorocarbon elastomers commercially available at this time.

The study showed many of the desirable properties of these elastomers in the fields of heat resistance, low-temperature properties, ozone resistance, electrical properties, oil, fuel, and chemical resistance, as well as the effect of compounding and processing variables.

A point of major interest was the announcement that a liquid latex form of Viton A will be available soon. Designated as LD-242, the product will have 60% solids, intrinsic viscosity of 1.0, be white in color, have average particle size of 0.4-micron, Brookfield viscosity of 15 cps., be of an anionic type, and appear to have excellent stability.

The polymer isolated from this latex will be similar to Viton A. It presents some compounding problems, but dipped films have been made by conventional latex techniques. Data on the physical properties are expected soon.

Based on the heat and fluid resistance of the fluorocarbons, an obvious place to use this latex form was in combination with asbestos as the binder in an asbestos sheet. The sheets were made by conventional practices of mixing, drying, and calendering. The results produced sheets with greatly improved tensiles and aging

resistance over the sheets without the latex binder.

Other improvements are expected in the fluorocarbons. Greater heat and chemical resistance can be expected in new polymers, and advances are being made in curing techniques. Easier processing is a hoped-for bonus in newer polymers, and with better plasticizers and lower costs due to greater volume of use the future of the fluorocarbons looks very bright, it was said.

"Cis-Polyisoprene and Cis-Polybutadiene—Process, Catalysis, and Results," by W. M. Saltman, Goodyear Tire & Rubber Co., Akron, gave some of the recent successes as well as some of the problems involved in the use of stereospecific catalysts for polymerization. The most famous of these polymers at the moment are *cis*-polyisoprene and *cis*-polybutadiene, but the basic ideas and research also apply to any of the so-called "tailored" polymers.

One basic feature of making either ordered polymers or ordered polyolefins is the requirement that no air or moisture be present, nor any polar material such as alcohols, ethers, ketones, esters, etc. The catalysts which can be used in these reactions make a long list. They cannot all be used for any reaction, though, and are very specific in the polymer that they will produce. A catalyst furthermore that will work for isoprene may not work for butadiene or some other monomer.

The selection of a catalyst is still done on an empirical basis. Much investigation and thought have gone into trying to develop theories and understanding of the catalytic process, but to date little is known of the actual mechanics of catalysis. Therefore the search for new tailored polymers is really a search for the proper catalyst, and until the mysteries of these systems are cleared up, this will continue to be so. It is hoped that some time in the near future the determination of the crystal structure of the catalyst or some other measurement will predict the polymer to be produced.

The two major catalysts today are the lithium or organolithium compounds and the Ziegler type used in the formation of the *cis*-polyisoprene and *cis*-polybutadiene. The Ziegler type for isoprene is a mixture of aluminum alkyl and titanium tetrachloride, and for butadiene, a mixture of aluminum alkyl and titanium tetraiodide. The ratios of Ziegler catalyst components as well as heat and pressure used determine to some extent the polymer obtained.

There seems to be some merit in the idea that the ordered polymer is determined by the ordered atomic pattern of the crystalline surface of the solid crystal catalyst although there are some exceptions to the solid state catalysts. The monomer is pushed, pulled, and twisted into the right configuration by the electric fields of the crystal surface and cannot join the chain unless its size is right. It must fit the surface as a key fits a lock, it was stated.

"Cis-Polyisoprenes and Polybutadienes—Properties and Uses." by Glen Alliger, The Firestone Tire & Rubber Co., Akron, list some of the properties and some of the uses or projected uses of these new polymers.

Synthetic *cis*-polyisoprenes have the properties of NR including low hysteresis and good strength at elevated temperatures. The lithium catalyzed polymer has high viscosity and must be plasticized like NR before use. The Ziegler catalyzed polymer has lower viscosity and does not require plastication.

Tire tests have confirmed the laboratory data showing that the *cis*-polyisoprene is equal to NR for wear and for heat build-up during tire operation. More then one million test miles have been built up by the Firestone test fleet on Coral rubber tires. Moreover some 14.00-20 military tires were tested and passed for military service by the Ordnance Department.

Coral is as good as NR for cold-temperature work; hence is as good for traction in ice and snow. It also is equal to NR in aging and better in tread crack resistance. It has been successfully tried in motor mounts and bushings for automobiles.

The economic picture for Coral (and presumably for Ti-Al polyisoprene) is that it awaits the lower price of isoprene in order to become really competitive to NR. While it could replace SBR physically, it does not look as though the price of *cis*-polyisoprene will fall in this range. The price of *cis*-polyisoprene is expected to be in the range of the average price of NR over the last three years if made in large quantities however. The present SBR plants do not seem to be practical for conversion to the production of Coral rubber. It will take some time to build up new plants for this production even after a go-ahead is given. This threat to the NR supply, however, should help hold the cost of NR down and also relieve the necessity of maintaining large stocks of NR on hand in this country.

Cis-polybutadienes offer many of the advantages of the isoprenes. *Cis*-polyBd does not have good strength in the uncured state and has poor tack. It is also very difficult to mix stocks of *cis*-PBd because it tends to break up in a hot Banbury or on a hot mill. Present plans seem to indicate a blend with NR as the best method of utilizing this new polymer. Tests indicate the 50/50 blends of NR and *cis*-PBd give tread wear 25-35% better than that of all NR and can be satisfactorily processed.

Both of these polymers could be used to reduce the need of natural rubber by replacement or partial replacement of the NR particularly for heavy-duty tires and other items. This should be of benefit if the impending shortage of NR expected in 1960-1962 becomes a fact.

Course in Statistics Methods at Brevard

The Institute of Statistics at North Carolina State College will sponsor a one-week intensive short course in statistics methods for research workers in industry and the physical sciences beginning the week of August 10. The course will be held at Brevard College, Brevard, N. C.

An elementary and an advanced section of the course will be held. Lectures in the elementary section will cover basic concepts, confidence limits, tests of significance, correlation and curve fitting, analysis of variance, and an introduction to design of experiments.

Among the topics in the advanced section will be variance components, multiple regression, response methods, and experimental design. Registration fee is $125.00. Enrollment will be limited to 50 students in each section. Further information and bulletins are available from the Division of College Extension, Box 5125, State College Station, Raleigh, N. C.

SPE Vinyl Men Form National VIPAG

Sixty representatives of the vinyl industry met January 30 at the Hotel Commodore, New York, N. Y., to attend the first formal meeting of the Society of Plastics Engineers' newly formed National Vinyl Professional Activities Group.

The purpose of the group (VIPAG) is to study and disseminate information about the processing, use, and compounding of materials used in vinyl plastics. Its goals are: (1) aid in forming local VIPAC sections; (2) provide liaison on programs between VIPAC sections; and (3) procure suitable technical papers for presentation at SPE ANTEC.

A steering committee will be appointed as an advisory body to the officers. National officers elected at this meeting were: Robert Abeles, ENE-chairman, Elfskin Corp., Worcester, Mass.; Saul Gobstein, vice chairman, Ferro Chemical Co., New York; and Joseph Clancy, Emery Industries Inc., Philadelphia, Pa., secretary.

Further information may be obtained from the secretary at 4343 E. River Dr., Philadelphia 29, Pa.

Fifteenth ANTEC Sponsored by SPE Draws 100 Papers on Plastic Subjects

The Hotel Commodore, New York, N. Y., was the scene of the fifteenth Annual Technical Conference (ANTEC) on January 27 through 30, sponsored by the Society of Plastics Engineers, Inc., Stamford, Conn. The meeting was attended by more then 3,000 members and interested guests who were able to hear the approximately 100 papers on all aspects of the plastics industry. The papers were presented at 26 individual sessions held each morning and afternoon during the four-day meeting. During most periods several sessions were held simultaneously.

While most of the papers were specifically aimed at the plastics field, many of the RUBBER WORLD's readers are also interested in some of them, and a few of the papers were of specific interest to the rubber industry. Listed below are abstracts of the papers felt to be of major interest to rubber technicians.

"Polybutadienes of Controlled *cis, trans,* and Vinyl Structures," J. N. Short, G. Kraus, R. P. Zelinski, F. E. Naylor, Phillips Petroleum Co., Bartlesville, Okla. The physical properties of polybutadiene vulcanizates have been measured as a function of polymer micro structure. Although the overall properties of any one polybutadiene are determined by the relative ratio of *cis, trans,* and vinyl units in the polymer chain, marked changes in physical properties do not occur until a relatively pure configuration is approached, or unless the raw polymer displays crystallinity. Thus, polybutadienes containing more than 85% *cis, trans,* or vinyl units are characteristically different from each other, and the differences are accentuated as the isomeric forms approach 100% of a given configuration. The *cis* configuration is a soft rubbery material, which, owing to its low heat build-up, may have a future as a diluent for natural rubber; the *trans* configuration, when pure, is a hard crystalline plastic, however, and resembles high-density polyethylene in appearance and, to an extent, in physical properties; the vinyl forms produce many differences in many physical properties, depending upon the particular ordered arrangement. While these polybutadienes are not yet available commercially, their unusual properties and potential applicability in many areas should lead to their manufacture in the future.

"Five Years of Progress in Stereospecific Catalysis Research," Giulio Natta, Polytechnic Institute of Milan, Milan, Italy. The progress made in the direct synthesis of alpha-olefin polymers of high steric purity, high crystallinity, and high melting point was reported. Early indications of the importance of the research in highly stereospecific polymerizations of alpha-olefins have borne fruit.

More than four years of laboratory research in the textile field were accompanied in Italy by the gradual development of a series of pilot plants of increasing capacity. Montecatini will soon supplant these with a large commercial unit of 10 million pounds annual capacity. This plant will produce staple fibers of several different types as well as high-tenacity yarns.

At Milan Polytechnic Institute, products belonging to a new class of stereo-ordered polymers have been prepared. These are polymers having a linear paraffinic chain of the CHR-CHR′ type in which carbon atoms linked to different substituting groups follow one another alternately. This has been done, for instance, starting from *cis* and *trans*-CHD=CHCH$_3$ monomers. [D equals deuterium.—EDITOR.]

Work done at the institute has established the relation between crystallinity and steric structure of the polymers.

Along with the discovery of highly stereospecific catalysts for the polymerization of alpha-olefins, highly stereospecific catalysts were also developed for the polymerization of diolefins. Thus the first crystalline butadiene and isoprene polymers with a high content (up to 99%) in *trans*,1-4 enchained units were obtained. Using catalysts of a particular type which contained only one kind of active center, crude butadiene polymers having a *cis*,1-4 content higher than 97% were also obtained.

Influence of steric purity on properties is tremendous. *Cis*,1-4 polybutadiene vulcanized in the absence of reinforcing fillers yields a rubber which has low initial elastic modulus and high tensile strength *only* if it is able to acquire high crystallinity under stretch. *Cis*,1-4 highly pure polybutadiene is the product nearest to *cis*,1-4 polyisoprene (i.e., to natural rubber) in elastic properties. It is now possible to regulate the molecular weight of polybutadiene directly in the polymerization steps and also to achieve a planned distribution of molecular weights.

The difference in properties between various polymers of different structures is due not only to the fact that they may or may not present crystallinity, but also depends in a determining way on the specific type of steric structure.

Highly pure *cis*,1-4 polybutadienes having a controlled molecular weight present good processibility and very good mechanical properties even in the absence of reinforcing fillers. They have good resiliency even at a low temperature. These properties change, however, with slightly impure forms.

"A New Theory of Stabilization of Mixtures Containing Polyvinyl Chloride," C. H. Fuchsman, Ferro Chemical Corp., Cleveland, O. The theory of polyvinyl chloride degradation was reviewed in the light of the differences in behavior of systems stabilized with Zn and Cd, *versus* those stabilized with "long-term" stabilizers. The differences were attributed to the differential pattern of dehydrochlorination, determining whether olefinic bonds or bonding to other molecules results from HCl removal. The latter, designated as dia-dehydrochlorination, of which cross-linking is a special case, favors oxidative free-radical degradation resulting in darker colored reaction products. Carbonyl groups in conjugation with olefinic groups are considered responsible for the darker color. The intensity of color is much increased if a helical arrangement of the polymer molecule is assumed, with dehydrochlorination-induced links between successive coils. Zn and Cd stabilizers promote good early color by favoring dia-dehydrochlorination, while the good long-term stabilizers—Ba compounds and epoxy compounds—appear to favor dehydrochlorination resulting in olefinic double bonds.

"The Use of Polyether Triols in Urethane Foams," R. K. Seizinger, S. Davis, J. M. McClellan, Jr., K. C. Frisch, Wyandotte Chemical Corp., Wyandotte, Mich. A new series of triols, propylene oxide adducts of trimethylolpropane, appears to be valuable for obtaining a wide range of physical properties in urethane foams. Depending upon the molecular weight of the triol used, the resulting products range from flexible foams for the higher weight members to semi-rigid and rigid foams for the lower molecular weight triols. In flexible foams some of the desirable properties gained include an increase in the load bearing properties, the retention of resilience while modifying other properties, improvement of compression set properties, and high impact absorbing characteristics.

"Modified Rebound Pendulum for the Evaluation of Flexible Foam Materials," L. A. Rosenthal, G. I. Addis, Union Carbide Plastics Co., New York, N. Y. By modifying a rebound pendulum, it is possible to study in greater detail the impact properties of flexible foam materials. The pendulum is integrated with a precision potentiometer so that angular position *versus* time curves can be plotted on a recorder. Typical observed data were presented and discussed together with the operation and theory of the equipment. It was suggested as a tool for future foam studies and may prove to be a substantial extension of existing tests.

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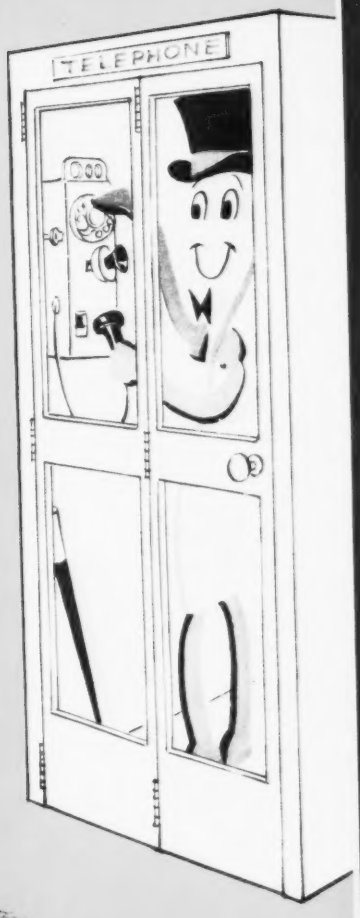

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Banbury Scorch Test Described to Tlargi

A method using an accurate and duplicable procedure for comparing the heat generating characteristics of rubbers and rubber compounding ingredients for predicting the amount of heat a compound will be subjected to during processing was described by C. A. Carlton, J. M. Huber Corp., Borger, Tex. Speaking to The Los Angeles Rubber Group, Inc., on February 3, Mr. Carlton said that a study had been made to develop this procedure, to compare various rubbers, carbon blacks, and inorganic pigments as regards heat generation during processing, and to study processing variables and procedures that might point the way to lower processing temperatures and thus provide more freedom from scorch.

Heat Generation Test

Mr. Carlton was the featured speaker of the technical session of the regular monthly Tlargi meeting held at the Biltmore Hotel, Los Angeles, Calif. He described this procedure which is run in a size B Banbury with set conditions of batch size, speed, ram pressure, cooling water, starting temperature, and mixing cycle. A standard mixing, aging and remixing procedure is also part of the overall test. The paper gave results of this test with batch size and Banbury speed as variables used to determine heat generation test values. A test is also given to show the duplicability of the test.

With these preliminary tests described, the paper went into some of the heat generating characteristic of SBR 1500, natural rubber, and NBR of high, medium, and low acrylonitrile content. Two NBR-PVC blends were also included in the NBR study. The study then took up the problems of black incorporation in natural rubber and in SBR 1500 using all grades of carbon black. This type of study was then repeated with the non-black pigments.

This test may be used to measure scorch time and, according to the speaker, is much more representative of the true scorch time than the current conventional Mooney scorch determinations. Carlton included in his paper four sole-type stocks to compare Mooney scorch times with Banbury scorch times. In one example cited, the compound appeared to be more scorchy by the Mooney test, but because of its more plastic nature, it did not generate so much heat in the Banbury and proved to be the safest stock to process.

A second variable which the author claims is not shown in a Mooney scorch test is the effect of mixing procedure. A test using a different method of accelerator addition on mix or remix gave identical results on the Mooney test, but when subjected to the Banbury heat generating test, the mix with the accelerators added in the first mix scorched badly at the end of 13 minutes; while the other was only slightly scorched in 25 minutes.

Carlton concluded that a procedure suitable for accurately comparing the heat generating characteristics of rubbers and rubber compounds during processing has been developed and is ideally suited for comparing rubber compounds of widely varying types as regards tendency to scorch.

Dinner Program

Following the presentation of Mr. Carlton's talk the 260 members and guests of Tlargi attended the dinner of the Group. During this dinner Roy N. Phelan, 1957 Tlargi chairman, presented the award of an Honorary Life Membership to L. E. "Bud" Budnick, a past chairman of the Group (1954) who has served since on many important committees and has now accepted the position of official photographer for the Group.

The dinner speaker was Dr. Jose Fernando Machado, of Brazil, financial advisor, humorist and world traveler. Prizes provided by rubber and supplier companies were distributed to holders of the lucky numbers by Charles "Chic" Hart, Midwest Rubber Reclaiming Co., prize committee chairman.

Keskkula on Styrenes

The Northeastern Section, ASC, Elastomer & Plastics Group held its first meeting of 1959 at Science Park, Charles River Dam, Boston, Mass., on January 20. About 75 members and guests attended the dinner and technical session. Speaker of the evening was Henno Keskkula, Dow Chemical Co., Midland, Mich., on the subject, "The Testing of Rubber-Modified Styrenes."

Dr. Keskkula spoke about the testing methods devised by his company for evaluating cracking and crazing properties of modified styrene plastics, and of methods for improving these properties. Such materials, used in refrigeration, are rigid, but must have impact resistance.

A series of samples was prepared including essentially gel-free rubber, cross-linked rubber, and styrene graft polymers and polystyrene blends with gel-free and with cross-linked rubbers. Analyses indicated that the desired graft and blended structure were actually secured.

Stress-relaxation studies of ¼- by ¼-inch samples in a high-speed (133 in./in./min.) test apparatus, designed by the speaker, were shown for 5-25% gel-free and cross-linked rubber blends in polystyrene. Where normal tests at speeds of 0.125in./in./min. went through a maximum, high-speed testing showed constantly increasing elongation with cross-linked content, and correlation with the notched Izod impact results.

Deflection tests on dinner-plate covers showed the samples strongest parallel to the molding flow lines and weaker at right angles, with the rubber-styrene polymer strength curves at higher temperatures drawing together for both methods. This latter polymer turns white but does not craze. Microscopic examination showed the cracks progressing from rubber particle to rubber particle, or ending in the styrene. Polystyrene cracks right through.

Injection molded samples were compared with compression samples, and tested with a dart-drop tester of the speaker's design. Resistance increased with temperature of extrusion cylinder and showed breaking tensile values of 3-6 for compression molded samples, 6-9 for injection molded samples, and 8-14 for extruded samples. Tensile ratio of parallel to perpendicular directions determined for polystyrene, styrene-acrylonitrile copolymer and rubber-modified polystyrene showed the following: 2.1, 1.25, and 1.5, respectively; while notched impact ratios (parallel to perpendicular) were: 4.0, 1.3, and 10.5, respectively.

Semi-log plots of dart-drop results versus perpendicular unnotched impact showed a straight-line relation, as did dart-drop *versus* deflection.

In summarizing these data, Dr. Keskkula concluded that best test results were obtainable: (1) using strain-free samples (compression moldings or thick extrusions), (2) using a falling dart test (impact) for toughness evaluation, (3) using a high-speed test, whether for stress-strain or impact, and (4) utilizing the new and old materials in combination.

Boston RG Ski Outing

Eighty-three members and guests, including seven young sons of the members, were present during the week-end of February 6-8, when the Boston Rubber Group, with Chairman-Elect James J. Breen, Barrett & Breen Co., as committee chairman, held its annual ski outing at Bartlett Inn, Bartlett, N. H.

Despite a dearth of snow, skiers found passable conditions on the east slope of Cranmore (skimobile) Mountain, and several cars traveled as far as Stowe and Mad River Glen, Vt., where there was excellent skiing.

Locally, the skating was very good, and, of course, the indoor sports of cards and good fellowship were the order of the day. A good time was had by all, and no accidents were reported.

Cured Polyethylene At Fort Wayne Group

"Vulcanized Polyethylene" was a term introduced and suggested for use in describing heat cured, chemically cross-linked polyethylene by A. C. Bluestein, Anaconda Wire & Cable Co., Marion, Ind., in Fort Wayne on February 12. This term is suggested in order to remove the confusion between irradiated polyethylene and chemically cross-linked polyethylene. Speaking to the Fort Wayne Rubber & Plastics Group at the February meeting at the Van Orman Hotel, Fort Wayne, Ind., Mr. Bluestein remarked to the 136 in attendance that the technology of compounding vulcanized polyethylene straddles the fine line between plastics and rubber. He said that the plastics specialist would have to gain new knowledge to handle this curing polyethylene and that the rubber technologist, while a little more able to compound it, would still have to change his thinking somewhat for this material.

While most people are inclined to think of vulcanized polyethylene as something new, the original work was done as far back as the early Forties, and Du Pont received a patent in 1948 on the use of inorganic peroxides with polyethylene. Most interest has been generated, however, since a paper given by Dannenberg, Godfrey L. Cabot, Inc., Boston, Mass., before the Gordon Research Conference in New Hampshire in 1957.

The compounds using MT black and dicumyl-peroxide were suggested since they were made from commercially available materials and gave a good balance of properties for most applications. The cross-linking of the peroxide ties up the black and changes the crystallite picture so that no crystalline regions remain to cause brittleness in the elastomer obtained when only black is added. There is still much to be learned about compounding techniques for these new materials, but even the simple compounds to date show very desirable properties, and it is expected that industry will find many uses for them.

RIRC to Hold Silver Jubilee Outing in June

The Rhode Island Rubber Club is planning to hold its twenty-fifth anniversary outing, the biggest and best yet, at the Hotel Belmont, West Harwich-by-the Sea, Mass., on Cape Cod's south shore, on June 12-14. Entertainment, top-flight speakers, golf, tennis, swimming, shuffleboard, putting, cocktails, and a special ladies' program will set a new high for sheer relaxation and comradery with members old and new.

Reservations received by April 15 will cost only $40. After that date, the whole package including Friday dinner, three meals Saturday, and two on Sunday plus room for Friday and Saturday nights, will cost $45. Golf and swimming fees will be extra. Rooms are nearly all double occupancy and will be assigned on basis of date of receipt of paid reservation.

A reservation form or other information is available from W. J. Blecharczyk, Davol Rubber Co., 69 Point St., Providence, R. I.

CCDA To Meet: Theme Is Diversification

The annual New York meeting of the Commerical Chemical Development Association will be held March 4-5 at the Statler Hotel, New York, N. Y. Its theme is "Diversification in the Chemical Industry." The session on March 4 will be devoted to panel discussions, followed by open-forum meetings covering specific areas including intermediates, plasticizers, surfactants, and plastics. On March 5 all registrants will have the opportunity to participate in small group discussions concerning case studies involving diversification.

According to R. W. Eddy and J. R. Dudley, program cochairmen, the program is designed to provide maximum participation and discussion by everyone in attendance.

Nitrile-Silicone Talk At Philadelphia Group

More information on the new nitrile silicone rubber was given to the Philadelphia Rubber Group by C. W. Pfeiffer, of General Electric Co., Waterford, N. Y. This new development in silicone rubber technology is reported to give added oil resistance to the temperature-resistant silicones. The original announcement was made by General Electric in August.[1]

Mr. Pfeffer gave a review of the original data and also included some new and expanded data on the product as well as further information on the availability and cost of the material. He announced that over the next few months different grades would become available for limited sampling of laboratory amounts. Cost will be somewhat higher than that of the current silicones, but will be expected to drop as production and use become more widespread.

These views were expressed by Mr. Pfeiffer during the after-dinner technical session of the Philadelphia Rubber Group's meeting, January 23, at the Poor Richard Club, Philadelphia, Pa. About 160 members and guests attended the session with chairman R. S. Graff, Elastomer Chemicals Department, E. I. du Pont de Nemours & Co., Inc., presiding. During the short business section of the meeting, the Group heard a report of a committee to establish a scholarship at the University of Akron. The Group approved the plans made with the University to have this scholarship which would be administered by the University, and which would go to graduate students specializing in rubber chemistry from the area served by the Philadelphia Group if such students are eligible or to any other qualified graduate students if there should be none from the Philadelphia area.

Announcement was made of the Group's next meeting, which will take the form of a symposium on sponge and foam rubbers to be held May 1 at the Poor Richard Club.

[1]See RUBBER WORLD, Sept., 1958, p. 904.

Reclaimers Reelect All Officers

The Rubber Reclaimers Association, New York, N.Y., has announced the reelection of all 1958 officers to serve during 1959. President is Thomas H. Fitzgerald, Naugatuck Chemical Division, United States Rubber Co. Vice president is John E. Brothers, Ohio Rubber Co.; and secretary-treasurer is Charles T. Jansen, advertising sales manager of *Adhesives Age* and *Rubber Age*.

These actions were taken at the Association's annual meeting in the Warwick Hotel, New York, on January 28. At this meeting Henry L. Dixon, B. F. Goodrich Industrial Products Co., was appointed chairman of the executive committee. Chester H. Peterson, president, U. S. Rubber Reclaiming Co., was named chairman of the education committee. This latter committee works closely with local rubber groups to provide speakers for meetings and lecturers for the various courses in rubber technology being offered by many of the groups.

Commodity Exchange Names New Officers

Harold A. Rousselot, general partner, Francis I. duPont & Co., recently was unanimously reelected by the board of governors of Commodity Exchange, Inc., New York, N. Y., to his

(Continued from page 916)

WASHINGTON REPORT

By JOHN F. KING

Government Synthetic Rubber Program Criticized in Senate

The creators of the American synthetic rubber industry—the technicians of the oil and rubber companies and the officials of the United States Government—have been subjected to a critical, even pitiless, roasting at the hands of the Senate Judiciary Subcommittee on Patents, Trade-marks and Copyrights.

An exhaustively detailed history of the development of the synthetic rubber industry, issued in February by the Subcommittee, should be of more than passing interest to rubber industry scientists and technologists. Certain to stir controversies, its central theme is that efforts during and after World War II to create a substitute for strategically crucial natural rubber were an utter failure, on all counts.

The author of this stern judgment is Prof. Robert A. Solo, Economics Department, City College of New York, and an established expert on the intricacies of the national and international patent systems. Besides producing a study "merely of historical interest," Solo has a message:

What was needed in the synthetic rubber crash program of wartime, and is needed now even more desperately, is a high level of "technological competence" within the government to "evaluate the results" of expenditures for research and development that currently range around $5 billion a year.

"Passing out cash is not enough," is the nutshell conclusion of Solo's 130-page review of the synthetic rubber experience. He expands his point with this thought:

"Large, reputable companies were taken into the program. They were paid well. The promise of profits was taken away. The threat of competition was removed. They were told to go discover, go develop, go find . . .

"But there was nothing to tempt or drive them. In consequence, they went through the motions; they honored their commitments. But nothing was discovered; nothing was found; nothing developed.

"The program did not fail because it was government-run. The government did not run it—it merely paid for it. But as events showed, passing out the cash is not enough."

GR-S Research Program Criticized

Lacking incentives to experiment and innovate, owing to the government's war-borne technology patent pool, the rubber and oil companies didn't even try for major breakthroughs, Solo declares. Knowing their discoveries would be available to prospective competitors once commercial conditions were introduced in the synthetic rubber market, these companies simply "went through the motions" of research and development in line with their "subsidy" research arrangements with the federal agencies involved.

Solo says he does not particularly blame the companies for their attitude, for business, after all, is driven by the mechanics of the profit motive. There was little more to be gained from participating in the government synthetic rubber program, in the view of the companies, than a secure position in the industry once it became privately operated, he says.

What was wrong, Solo argues, was that the government, without giving a thought to the logical collision of private and public interests, tried to harness the dynamics of the profit motive to winning the war, a "social" and "strategic" end. The government rightly sought the technical advice of the oil and rubber companies, he says, but erred in depending entirely on the companies for the organization of the new enterprise. It aggravated the error in saddling upon the companies the incentive-killing patent pool.

Solo concedes that the decisions were made in an atmosphere of emergency and that the government was therefore under extreme pressure. Thus the pool had the immediate, short-run advantages of minimizing the "immediate problem of negotiation" as between patent holders under the stress of wartime urgency, plus the advantage of limiting the government's liability in later disputes over patent rights.

But the know-how arrangements had these drawbacks, most of which were of a longer-run nature and did not show themselves as disadvantages until after the government and the company participants were deeply committed to the program:

"(1) They eliminated the profit incentive that companies might otherwise have had to develop lower cost processes and better products for the government-owned industry.

"(2) They created a positive deterrent to the incorporation of new and more efficient methods into the government operation.

"(3) The elimination of the agreements permitted a hidden sphere of private research to develop, but no new inducement was offered for the development of improved processes or products in the plants operated by these companies for the government, or for the incorporation of more efficient known methods into government operation.

"(4) Some provision was made in the patent agreements to facilitate turning over patent rights and technological information to the prospective purchasers of plants. Often, however, these provisions were vaguely worded and their value as safeguards was uncertain. Their value was to be indicated subsequent events"—a reference to the fact that the purchasers of the synthetic plants after 1953 were those same companies which operated them under wartime and postwar government ownership.

"(5) No provision was made to assure that patent rights and technical know-how would be generally available to newcomers in the industry, other than potential purchasers . . . an assurance that would have encouraged the creation of competitive conditions in the future." This point also refers to Solo's contention that "newcomers" who had not participated in the operation of the plants during government ownership would be inhibited by their lack of technological know-how from bidding on the properties when they ultimately were put up for sale in the Eisenhower Administration.

Returning to his thesis that "nothing of importance" came out of research programs both in the patent pool and

later in postwar government synthetic research efforts, Solo maintains that "all the major developments" as well as the "minor discoveries and innovations" had their origin and initial development outside the government-financed subsidy program.

"Devouring funds to the tune of $50 million" between 1945-55, Solo says, the government-underwritten research program "never transcended mere routine. It never showed vigor, vision, originality. It never produced the results that count in significant innovation. The innovation that came, came from the peripheral private research beyond its orbit."

His evidence here is that there were only two "primary research developments" in synthetic rubber in recent years—discovery of cold rubber and oil-extended GR-S. In the category of "secondary research developments," Solo lists (1) conversion of oil feedstocks into butadiene; (2) the black masterbatch technique; (3) cold-resistant butyl; and (4) high-abrasion carbon blacks.

In the case of all these research developments, primary and secondary, Solo points out, the four companies successful in the breakthroughs were not involved in any research contracts with the government at the time of their discoveries, although they later were brought into the government's "subsidy" research programs. A "more striking story," Solo continues, deals with the development of synthetic "natural" rubber.

Solo then recounts the history of Goodrich's researches which led to that company's successful patenting of the synthetic-natural process, developed outside the government-sponsored research program. He also takes note of the legal difficulties enmeshing the Goodrich process since its discovery—the Justice Department is suing BFG on behalf of the old Rubber Reserve of the Reconstruction Finance Corp., attempting to break the company's patent—and seems to argue the government hasn't a leg to stand on in the issue.

The Oil-Extended Rubber Story

The Solo survey, by way of reinforcing its argument that the government's "subsidy" and know-how pooling research programs were a mistake, reviews the Emmet Pfau affair. Pfau, a Goodrich researcher who developed the oil-extended GR-S formula, could not interest his company, then under Rubber Reserve contract covering GR-S research, "in initiating new developments in this field," according to Solo.

Because Pfau would not abandon his project, he offered his services to The General Tire & Rubber Co., which had no research contract at the time. According to Solo, General hired Pfau and enabled him to continue his work.[1] However, actual development of oil-extended GR-S could not take place, nor could the new process be used in the facilities which General operated for the government, Solo says, because General would then be obliged to reveal the development to the government, hence the patent pool, in line with General's operating agreement with RFC.

Although General got around this problem for a time by entering into an agreement for oil-extended GR-S production with Polymer Corp., Ltd., of Canada, it eventually ended up "unable to profit" from Pfau's enterprise because it was "brought into the government program" later, and General had to pool its know-how. The same fate befell Phillips Petroleum Co., according to Solo, which developed cold-rubber technology on lines set down in captured German research papers. Goodrich, Solo says, had known about and used the cold-rubber synthetic process before World War II, but had had its proposal to use the process "vetoed" by government officials during the war emergency "because of the critical shortage of refrigeration machinery."

The Solo study is replete with similar experiences he claims happened as a result of the confusion growing out of the mobilization effort. His study also capitulates the pioneering and legally questionable role of Standard Oil of New Jersey in securing the synthetic rubber technology of the German I. G. Farbenindustries during the interwar period.

Senate Comment

Prefacing the long report is a note by the Patents Subcommittee chairman, Sen. Joseph C. O'Mahoney (Dem., Wyo.), that the views expressed by Solo are his own and "in no way signifies acceptance by the Subcommittee of the statements" contained in the report. O'Mahoney said, however, that the Subcommittee believes that the study represents a "valuable contribution to patent literature" and that the "public interest" is served by its publication. O'Mahoney's preface was dated December 23, 1958, but the report itself was not made available until early February. O'Mahoney said the Solo report was prepared as part of the Subcommittee's study of the U. S. patent system, as called for by Senate Resolutions 55 and 236 of the last Congress.

[1] See RUBBER WORLD, June, 1951, p. 309.

RMA Forms Public Affairs Committee To Maintain Close Congress Contact

The rubber industry's representatives in Washington have jumped feet first into the growing argument between the "spenders" and the "savers" over the future course of federal fiscal policies. A new "Committee on Public Affairs" has been set up within The Rubber Manufacturers Association, Inc., to keep tabs on a score of legislative issues which are of direct interest to the industry and also to American business as a whole.

Sears To Head New Committee

The Committee will be headed by RMA Vice President W. J. Sears, according to an announcement by Association President Ross R. Ormsby. RMA's board of directors, Ormsby said, took notice in setting up the Committee of a growing realization on the part of the industry's management that legislative decisions figure importantly in the "business climate" of the nation.

Sears said creation of the Committee marks an upsurge of interest among the rubber companies in keeping in closer touch with national legislative issues of direct and indirect concern to them. Two years ago, he said, "people just weren't that interested . . . things were going along pretty well, and there was no need to get exercised." But the situation is different now, he said, pointing to the first major policy speech by Commerce Secretary Lewis L. Strauss in Chicago on February 11. The Commerce chief called on businessmen to help defend the economy against "unwarranted" wage demands and urged them to help the Administration win its battle for the anti-inflation, balanced federal budget by restraint where government spending is concerned. Admiral Strauss stressed "personal action" on the part of businessmen toward these goals.

Sears has been a driving force behind establishment of the public affairs group. His speech to the annual meeting of the Association in New York late last year was an admonition to the rubber industry to mobilize itself for the defense of economic conservatism.

When the Committee is organized, Sears says he hopes to have either a board director or an alternate from the larger companies on the Committee. The smaller companies could be represented either by the president or the Number Two man in the organization, he added. Mr. Ormsby declared the panel's first and most important job is research—development of factual information about proposed legislation that can be bulletined to the industry. The Committee's secondary function will be to make factual information available to Congress to keep the lawmakers advised of the industry's viewpoint on each legislative question that arises.

Issues of Importance

Here are some of the issues of deepest concern to the new group:

INVESTIGATION OF TIRE INDUSTRY MARKETING PRACTICES, to be made by Sen. Hubert H. Humphrey's Senate Small Business Subcommittee on Retailing, Distribution, and Fair Trade Practices. The Humphrey Subcommittee in late February issued investigation agenda for the coming session which placed the tire distribution probe high on the priority list. Subcommittee staff members said the investigation, which the rubber companies feel aims restrictions at the direct selling operations of tire manufacturing companies, should begin by late March.

TAX LEGISLATION. The foremost issue here is the increase by 1½¢ to 4¢ per gallon in the federal tax on gasoline. Proposed in President Eisenhower's fiscal 1960 budget to put the Interstate Highway system back on a pay-as-we-go basis, the tax boost is violently opposed by the rubber industry along with other highway "users" who have banded together against the whole idea under the banner of the National Highway Users Conference.

Other proposals in the tax field the Committee will keep its eye on are the Boggs bill to ease taxes on foreign earnings, and the Herlong-Baker tax reform bill, much favored by business generally.

Standing in the way of any substantial tax modifications, however, is the clearly stated determination of the House Democratic leadership to resist any general change, up or down. The day President Eisenhower proposed the gasoline tax increase, House Speaker Sam Rayburn (Dem., Tex.) announced it didn't have a chance. This judgment was confirmed in mid-February by Chairman Wilbur D. Mills (Dem., Ark.) of the tax-writing House Ways & Means Committee. Mills in a speech sealed the doom of the gasoline tax hike, for this year at least. The Arkansas Democrat also has shelved the idea of his Committee colleague, Rep. Hale Boggs (Dem., La.), to enact legislation lightening the tax load on foreign-earned income. Mills, however, has left the door open to action on the Boggs bill in the second half of the 86th Congress next year.

LABOR LEGISLATION. The RMA Public Affairs Committee will keep close watch on the new Labor reform bill of Sen. John F. Kennedy (Dem., Mass.), thought to be too "soft" on labor for either the Eisenhower Administration or U. S. business leadership—and on the "tougher" reform bill offered by Sen. Barry Goldwater (Rep., Ariz.).

BUSINESS REGULATION LEGISLATION. RMA is prepared to fight, if it has to, the old battle over enactment of S-11, which would nullify the "good faith" defense against price discrimination charges under the anti-trust laws. Other bills pending would require notification prior to corporate mergers; mandatory functional discounts requiring sales to wholesalers at prices lower than to retailers; and 30 days' advance notice to Congress where prices and/or discounts are offered to any single customer.

U. S. To Support NR Project in Guatemala

The United States Government in February agreed to put up part of the money and provide the technological know-how for an ambitious program to establish natural rubber production on 80,000 acres of Guatemala's Pacific slope.

The Development Loan Fund, the new agency set up under the foreign aid program to offer easy-credit loans for underdeveloped countries, is lending Guatemala $5 million to help meet the cash requirements of the plantation scheme during the first four years of its seven-year development schedule. It is expected that by 1966, Guatemala will begin to realize income from actual tree tappings, and that, when matured, the trees will produce 40,000 tons of raw rubber worth about $20 million annually.

Coupled with DLF's financial aid will be technical assistance provided by the U. S. International Cooperation Administration. ICA handles this aspect of U. S. foreign aid, popularly known as "Point Four" assistance.

With some 200,000 acres suitable for rubber production in Guatemala, it is expected the plantation project "will create an incentive for other rubber-growing projects" in the Central American country, according to DLF. The agency estimated that it will take a total of $41 million—including about $25 million in private investments—to finance the 80,000-acre planting program which DLF is partially underwriting.

Rubber growing in Guatemala was started in 1942 with the assistance of the U. S. Department of Agriculture, but never became an effective contributor to the country's economy. With the world coffee market in the doldrums—Guatemala depends on coffee exports for 80% of its foreign exchange—the Latin American country is trying to diversify its production.

DLF said the $5-million loan, when negotiations are completed, will require repayment in U. S. dollars over a 12-year period at an interest rate of 5¾%. DLF was set up under the foreign aid program to grant fire-sale credits to economically backward countries—loans that do not amortize for as long as 20 or more years and which may be repaid in the "soft" currencies of borrowing nations. Technically, the DLF loan will go to the Bank of Guatemala, which will relend the funds to private investors who win the approval of the Guatemalan Government.

In other developments on the foreign scene of interest to the rubber industry, the United States signaled a renewal of cordial relations with Indonesia in the February 9 disclosure that U. S. arms shipments to the island republic are being resumed. U. S. arms sales, as well as the friendlier brand of diplomatic relations with Djakarta, had been in a state of suspension for some months while Indonesia's civil war raged on.

Resumption of arms shipments followed reports late in January and early in February that rebels in North Sumatra were raiding American rubber plantations and causing "heavy damage," such as a reported $100,000 loss growing out of a five-week period of attacks on a Goodyear plantation south of Medan. Officials here, however, were unable to ascertain that Goodyear had lost more than one truck, which was burned, and that United States Rubber's plantation, also on Sumatra, had two unused smoke sheds burned down.

Increased European NR Consumption Predicted

As 1958 shaded into 1959, Europe took two giant economic leaps—Currency Convertibility and the European Common Market. These promise to provide a tremendous prod for world trade, in general, and European rubber consumption in particular.

With regard to resulting growth in European natural rubber usage, H. C. Bugbee, president, Natural Rubber Bureau, Washington, D. C., points out in the industry's February *Natural Rubber News* that projected consumption growth abroad could well tax natural production for years to come.

On December 29, 1958, Britain and the other European countries moved into currency convertibility—a major step toward free convertibility of their currencies. This is also a step which should open the door to increased American trade with and investment in Europe. On January 1, 1959, began the European Common Market, with its 10% cut in duties across the board between Western Germany, France, Italy, and the Benelux countries.

As a result of these two sweeping economic transfusions, an outstanding group of economists associated with the National Foreign Trade Council recently predicted a $1.8-billion rise in United States trade with other nations during 1959. The Chase National Bank refers to the movement toward closer economic integration in Western Europe as possibly being "one of the most significant economic developments of our time."

With an eye to the unprecedented trade expansion on the horizon, Bugbee points out that "total European demand for rubber products will expand importantly in 1959, dramatically in 1960 and subsequent years."

He stresses, too, that because of the projected rise in inter-country shipping, "Europe's truck tire business will expand to a proportionately larger degree than other segments of European rubber usage."

This would be directly beneficial to the natural rubber industry. Because of natural's greater resiliency and ability to dissipate heat, heavy truck tires are in the main made of natural rubber.

To meet the expected rise in demand, rubber producers of Southeast Asia, particularly Malaya, are increasing their replanting efforts. Budgrafted rubber used in such replanting can produce from 1,500 to 2,000 pounds of natural rubber per acre, per annum. This is in contrast to the approximately 490 pounds now yielded by Malayan acreage.

Referring to this increased yield, and some million acres of new land that Malaya expects to put under rubber production over the next several years, the Honorable Tan Siew Sin, Malaya's Minister for Commerce & Industry, noted in a recent statement that Malaya's production is expected to reach from 850-900,000 tons by 1965.

With Malaya forecast to produce some 680,000 tons in 1959, this would add approximately 200,000 tons of natural to meet rising world consumption.

1959 Rubber Industry Wage Talks Have Begun

Late February and early March will see the beginning of negotiations between the United Rubber Workers Union and the Big Four rubber companies on the renewal of company-wide working agreements, supplemental unemployment benefits (SUB), and pension, severance pay, and insurance pacts. Key date in the talks is April 9, expiration date of URW's contracts with United States Rubber Co. A strike at U. S. Rubber could paralyze contract talks and set off strikes against the other Big Four firms—Goodyear, Goodrich, and Firestone—whose contracts expire April 15.

That the union is prepared to make substantial demands can be seen in recent statements by URW leaders. Union President L. S. Buckmaster argues that even with the recession the industry had a "miraculously good year in 1958"—Goodyear's earnings, for example, set an all-time record despite the fact the company's sales were off 4%.

Moreover, Buckmaster claims, 1959 will be even better for the rubber companies; so he warns that industry management won't be able to wave a "crying towel" during the contract negotiations. The rubber manufacturers are going to make more money this year, Buckmaster continued, regardless of whether automobile production picks up at a faster rate or not.

For their part, the rubber companies are saying little about the negotiations and the chances for settlement with URW. They will depend heavily, however, on the strength of public opinion, which is being cultivated by government officials from President Eisenhower on down for restraint on the part of both business and labor, particularly labor, to hold down inflationary wage settlements.

Covering some 90,000 URW members employed in Big Four plants across the country, the negotiations began February 27, when preliminary union talks with U. S. Rubber opened at New York's Park Sheraton Hotel. Actual negotiating with U. S. Rubber began March 3. Following is the schedule for talks with the other companies.

Goodyear—Preliminary union negotiating committee meeting started in Cleveland's Carter Hotel on March 6. Actual negotiations with company representatives began March 10.

Firestone—Actual negotiations began March 10 in Cleveland's Tudor Arms Hotel, with preliminary union committee meetings beginning March 5.

Goodrich—Negotiations with company officials began March 10 in Canton's Onesto Hotel, with preliminary meetings starting March 6.

INDUSTRY NEWS

Business International Surveys Free World Economy for 1959

A general summation of international business expectations for 1959 was the theme of a publication recently issued. This publication suggests that international division budgets for 1959 should be based on an expected rise in sales of goods made in foreign factories —and, with some exceptions, on a decline in exports of United States manufactured goods. This booklet, "The Business Outlook for 1959 in 26 World Markets," was published by Business International, New York 3, N. Y., and is a special report in addition to the regular weekly reports issued by this organization. The 26 areas or countries covered are the same as featured in the regular reports, but are presented all in the same issue rather than being the featured country in any one issue. Each regular report covers one of the 26 areas, thus each is covered twice during the year.

Free World Economy in 1959

To introduce the reports in the 1959 Outlook is a two-part summation. The first part is an analysis of the free world economy from which the conclusion above was reached. Based upon conferences with executives of 50 manufacturers with extensive overseas operations, this summary suggests that the United States is pricing itself out of world markets, and thus exports will continue to fall in 1959. Overseas plants will, for the most part, show increased sales. The prospect for commodity price stabilization is dim because it requires worldwide collaboration. This is not in prospect in the free-world because the USSR will use available resources to disrupt commodity prices.

The second part of the introduction gives a country and currency analysis in capsule form for many of the important world areas. In general, this gives a rather better looking picture for European areas, but not too encouraging a one for Latin America or Asia.

1959 Business Outlook by Countries

Being more specific, the Outlook in a summary of the regular report calls for a 40% rise in the cost of living for **Argentina.** The trade picture is brighter, with a significant boost in exports going a long way to eliminate a trade deficit for the year. Severe restrictions are expected to remain on imports.

Australia is slowly recovering from the recession caused by the drought and low wool prices. This depressed economy will be spurred by deficit

financing. Recent dollar liberalization will be continued despite the worsening position regarding deficit payments.

Imports should fall 10% in **Belgium,** pushing exchange reserves to record highs. Production will remain at about present levels for at least half the year. The government will try to spur new industry, particularly in the south where marginal coal mines are forcing miners out of work.

The appointment of a new finance minister in **Brazil** brightened the outlook somewhat, but the large excess of coffee is still a major problem. A deficit of $500 million in balance of payments will depreciate the cruzeiro further. High labor and import costs will spur this trend toward inflation. There will be no change in the exchange system or support policy on coffee prices.

In **Chile** some pickup, although probably slight, is expected in economic activity. Continued inflation will mean about a 25-point increase in COL. Unless copper prices improve, import restrictions will continue.

Colombia, although another coffee country, is not in as bad shape. The economy has shown remarkable resiliency in meeting the problems of a hefty devaluation in the peso and the drop in coffee prices. Expected increased exports in 1959 will continue the improvement in balance of payments in spite of imports continuing at a $22-28-million-per-month rate. Political stability marked by a steady, conservative program of public and private austerity will keep the country in good condition.

The outlook for **Cuba** was based upon prerevolution conditions. The economy had been badly weakened by the fighting and disrupted services. A new report will have to await developments to see how the economy will react.

Austerity will no longer mark the policy of **Denmark.** The government has apparently decided to return gradually to normal expansion. Exchange reserves continue to build up, but production will remain stagnant. There will be a drive to attract new investment, with offers of special benefits.

Political stability is now in effect for **France,** but devaluation and inflation are the worries of businessmen now. The Gross National Product (GNP) should rise 3%, with industrial production up 5% for the year. The budget deficit will be in the range of $1.4-1.9 billion.

The outlook for **Germany** is for continued economic expansion, but at a slower rate than in the immediate past. The GNP should rise 4% at real prices and up to 6% at current prices. Textiles, coal, and steel feel recession chills; while better terms of trade pile up exchange reserves.

India will be bailed out of her most pressing needs by massive current and prospective foreign aid along with the government's decision to subsidize exports and reduce certain excise duties. Production will pick up, as will sales in consumer goods industries. Inflation will grow, however, caused by deficit financing and slashed imports which will add to labor unrest.

The slight recession of last August seems to be over for **Italy.** Higher agricultural yields offset dips in industrial production. As a result, the GNP at constant prices will increase about 3.2%. Wages are expected to level off after a 6% increase in 1958.

Exports lower than those required for an end to the recession which grips the economy of **Japan** are forecast. Unless exports pick up, Japan cannot truly get on its feet. Extension of yen credit to foreign importers to purchase Japanese goods will be pushed.

Mexico is expected to follow the United States in recovery. Business will pick up owing to wage hikes and record crops. Imports will be increased, especially of manufactured goods. Inflation will continue, with GNP rising 8-10%. Devaluation is expected at any time.

Industrial production fell in 1958 to below the 1957 record highs in the **Netherlands,** but 1959 is expected to resume the climb. Holland has resisted better than most nations the United States recession and worldwide dampening of activity. Exports continue to rise, and orders continue to come in even though there is no large backlog on the books.

Although 1958 saw **Norway** go deep into trade deficits, the result of reduced shipping revenues, no restrictions on imports are contemplated. The drain on reserves is counted upon to make up the deficit until shipping rates firm up and the worldwide recession ends. The COL has climbed seven points and is expected to continue to rise. Production and exports contracted to match, somewhat, the imports.

Pakistan's economy is in an extremely precarious position. Even when jute and cotton, the two primary exports, were in demand with firm prices, the country suffered a severe shortage of foreign exchange. The current world recession has raised the specter of bankruptcy. Even the suspension of the parliamentary government and resignation of the President with the assumption of power by the army has not aroused too much hope. While the army reign is attacking graft, corruption, and inefficiency, it may not have the wisdom and the ability to cope with the economic problems. Foreign aid is the only hope for saving the economy, but even this may not succeed.

Serious reverses have beset the **Peruvian** economy, and there is need of concern. Nevertheless, owing to credit restraints and higher tariffs there is room for hope. Higher taxes are in prospect, but with some revisions to make the structure simpler. The sol probably will be stable in 1959, backed by $100 million in standby credits and funds for essential imports.

The outlook for the **Philippines** is grim. The country is nearing bankruptcy and has instituted an austerity program and is seeking loans. The government has maintained too many public works and development projects that are deficit-financed and drain dollar reserves. Little improvement is expected in industrial activity and unemployment in the immediate future.

Although **South Africa** suffered from the 1958 recession, and from the fall in world prices on its raw material exports—wool, lead, copper—there is much optimism in both government and private quarters. Reserves continue to decline, but no plan has been made to restrict imports. Production in industry and mining continues at a steady level. Agriculture was hit by pests during 1958 and this fact plus surpluses in sugar and wool gave reduced profits for farmers.

Despite fighting in North Africa, very bad winter floods in Valencia, and a still-below-normal citrus crop, **Spain** is beginning to get results in its plan to revitalize its economy. Industrial gains continue in spite of raw material and machinery shortages. An Interministerial Committee has been studying the possibility of liberalizing foreign trade.

An expensive old-age pension plan will be reconsidered in 1959 in **Sweden.** It was postponed early in 1958. This would add upward pressure to labor costs in a country already burdened with mounting costs. Unemployment has been increasing, and markets abroad have been contracting. The government is conscious of the fact that high costs are at least a partial cause for the decline in exports and is trying to prevent any stimulant to domestic industry that would increase these costs. At the same time a drive for increased exports will be made.

Switzerland has not felt the recession too much, and its economy goes on in a comfortable way. There have been a few soft spots in the textile, construction, and watch industries, causing a small decline in industrial production, and pressure is on from labor for wage hikes and more fringe benefits. Imports have declined also, but are expected to improve. World tensions during 1958 brought an unusual flow of dollars into this neutral country.

Western aid of $359 million plus some other credits and loans may have taken some of the edge off **Turkey's** exchange shortage in 1958. This shortage has forced some plants to close owing to a lack of raw materials. Turkey has concentrated too much on basic industry and not enough on secondary industry. Bumper crops in 1958 have faced smaller export markets, but expansion of facilities, such as a sugar refinery, continues.

The **United Kingdom** expects that 1959 will provide the recovery long awaited during 1958. Exports did drop

somewhat during this period, but reserves stood at a record high. Industrial production is expected to decline and unemployment to rise before the recovery becomes effective. Wages and prices, however, are expected to remain stable.

Elections were held in **Venezuela** in December, 1958, returning to power Romulo Betancourt, who was president from 1945 to 1948. While this is a victory for the left, he won without Communist support. First post-election reports indicate a realistic recognition of the country's need of foreign private investment and, by the same token, the need of giving foreigners equitable treatment.

RUBBER WORLD'S Editorial Advisory Board Meets To Plan 1959 Editorial Program

The 1959 meeting of the Editorial Advisory Board of RUBBER WORLD was held on February 13 at the new offices of RUBBER WORLD and its sister publications of Bill Brothers Publications, Inc., 630 Third Ave., New York, N. Y. This Editorial Advisory Board has been an essential part of the editorial program of RUBBER WORLD since 1946 and in no small way contributes to the high quality and scope of its editorial content.

Members of the Board, selected from leaders in various branches of the rubber industry and its technology, are available to the editors for consultation and advice throughout the year and meet with the editorial staff once each year to review past performance and join in the planning of the editorial content of future issues. Board members not only contribute articles and other material for publication from time to time, but also provide information on the most important and interesting subjects about which material should be obtained. In addition, they participate in the evaluation of material on hand and, when it proves necessary, in the review of articles for publication.

Members of the Board serve as long as they so desire, and when they resign for reasons of their own, they are replaced by equally competent men in their particular field; the replacement often is suggested by the retiring Board member. Former Board members include such men as the late C. C. Davis, for many years chief chemist, Boston Woven Hose & Rubber Co.; J. H. Dillon, formerly assistant director of the chemical and physical laboratories, Firestone Tire & Rubber Co., and now research director, Textile Research Institute; Harry L. Fisher, former director of organic research, U. S. Industrial Chemicals, Inc.; and A. E. Juve, now manager, technical service research at the B. F. Goodrich Research Center.

The accompanying photograph and the one on the cover of this issue show the Board members and some members of the RUBBER WORLD staff at the February 13 meeting. Unable to attend this meeting and therefore not shown in these photographs were Walter S. Edsall, development manager, Goodyear Tire & Rubber Co., Windsor, Vt., and P. D. Brass, group leader, United States Rubber Co. Research Center, Wayne, N. J.; and Richard S. Walker, RUBBER WORLD's technical editor, who was not present when the photographs were taken.

Morningstar-Paisley Announces New Plant

Production of liquid vinyl chloride and natural and synthetic latex compounds was recently begun at the new Clifton, N. J., plant of Morningstar-Paisley, Inc., in line with an expansion of the company's latex and plastisol sales and technical departments. The new plant, which includes 100,000 square feet of manufacturing space, adjoins the company's recently acquired Haberland facility. The Clifton plant will produce the bulk of the plastisol, organosol and latex products in the Morningstar line.

The plastisol line, including organosols have been trade marked Morpasol. These consist of flow-controlled formulations suitable for dipping, rotational and slush molding techniques, as well as spray, roller and knife coating types. The latex products have two designations: Morpalex, a prevulcanized system, for safer handling and improved heat and light stability; and Morpatex, a line of textile latex coating compounds created to meet the needs of the upholstery, rug, and carpet industry.

1959 RUBBER WORLD Editorial Advisory Board meeting: *left to right*, J. H. Fielding, vice president, Armstrong Rubber Co.; B. H. Capen, technical manager, Tyer Rubber Co.; John M. Ball, eastern sales manager, Midwest Rubber Reclaiming Co.; E. B. Newton, manager, rubber research, B. F. Goodrich Co. Research Center; R. E. Wening, assistant editor, RUBBER WORLD; R. G. Seaman, editor and general manager, RW; J. J. Allen, chief chemist, Firestone Industrial Products Co.; L. H. Howland, manager, research services, Naugatuck Chemical Div., United States Rubber Co.; G. W. Kuckro, consultant to General Electric Co., wire & cable department; and S. D. Gehman, head, physics and electronics research, Goodyear Tire & Rubber Co.

Rubber Industry Stocks Rate No. 1 in Gain Rate During Bull Market's Last 17 Years

BARRON'S GROUP STOCK AVERAGE GAINS DURING 1958 *versus* CORRESPONDING GAINS SINCE START OF CURRENT BULL MARKET 17 YEARS AGO

Computed by D. E. Cable — January 27, 1959

Name of Group	% Gain 1/2/58 to 12/31/58	% Gain 1/2/42 to 12/31/58	Order of Gain 1/2/58 to 12/31/58	Order of Gain 1/2/42 to 12/31/58
Rubber	37.9	2950.8	19	1
Office equipment	72.4	1284.9	2	2
Investment trusts (leverage)	34.4	989.3	22	3
Liquor	47.3	811.6	12	4
Steel and iron	57.0	758.9	7	5
Oil	26.7	737.6	29	6
Building materials & equipment	35.9	603.9	21	7
Paper	23.8	580.2	31	8
Grocery chains	52.6	570.2	9	9
Dow Jones—utilities	32.0	535.5	25	10
Instalment financing	30.5	531.3	26	11
Dow Jones—rails	57.8	491.3	6	12
Electrical equipment	28.9	471.3	28	13
Automobiles	47.4	443.1	11	14
Insurance stocks	39.1	425.4	18	15
Dow Jones—industrials	32.9	417.6	23	16
Dry goods	43.5	406.8	13	17
Aircraft manufacturing	— 2.2	379.7	33	18
Drugs	51.4	326.7	10	19
Foods	37.6	313.4	20	20
Air transport	64.8	305.3	3	21
Chemicals	22.0	272.0	32	22
Motion pictures	56.8	264.3	8	23
Farm equipment	58.3	228.0	5	24
Automobile equipment	40.6	206.5	17	25
Packing	62.6	200.0	4	26
Bank stocks	30.1	196.9	27	27
Machinery (heavy)	25.1	183.1	30	28
Textiles	87.5	153.0	1	29
Tobacco	43.3	117.4	14	30
Gold mining	42.5	101.0	15	31
Railroad equipment	41.3	93.5	16	32
Copper, lead, zinc	32.7	67.8	24	33

Note: See "Barron's" of Apr. 21, 1947, (p. 49) and of Nov. 3, 1958, (p. 53) for names of individual stocks comprising each group.

Did you know that rubber industry stocks, at least those of the Big Four rubber companies as used by *Barron's* financial weekly in its Group Stock Averages, rate number one among the 33 industry stock groups in order of gain since the start of the current bull market 17 years ago? We didn't until it was pointed out to us by D. E. Cable, a research chemist at the United States Rubber Co.'s Research Center, who has made a hobby of following the changes in these group stock averages in *Barron's* for many years.

The accompanying table, as prepared by Dr. Cable, shows the % gain for all of the industry groups listed by Barron's each week not only for the January, 1942, through the December, 1958, period, but also for the period January, 1958, through December, 1958. During the past year rubber industry stocks rated nineteenth in order of gain behind textiles, office equipment, and air transport, the leaders last year in that order, but ahead of drugs, automobiles, and liquors, which ranked tenth, eleventh, and twelfth, respectively.

Dr. Cable suggested the possible publication of his findings in RUBBER WORLD since they should be of interest to employes in the rubber industry and investors everywhere who might be seeking growth stocks for future purchases which can be depended upon to outperform the market as a whole. Obviously we thought Dr. Cable had a point, and his table is presented herewith.

Polymer's '59 Budget

The 1959 capital budget of the Polymer Corp., Ltd., Sarnia, Ont., Canada, as recently announced, reflects the general competitive conditions which prevail in the synthetic rubber industry on a worldwide basis. It provides for expenditures of $6.6 million, all of which will be fully generated by the company's operations. A sum of $4.2 million is for improving plant efficiency and product quality, providing increased operating flexibility, and reducing operating costs. Also included are extension of employe facilities and continuation of the program of waste disposal systems.

This amount also makes provision for the beginning of a butadiene plant in western Canada. Owing to delays in the assured build-up of substantial gas exports in Alberta, Polymer has not yet completed the butane agreements necessary to supply the proposed plant in Alberta. The use of field butanes processed in Alberta continues to be the best means of filling Polymer's butadiene requirements.

The remaining $2.4 million is allocated to projects already under way and is providing winter employment for about 150 construction workers in Sarnia. The new pilot plant for work on new polymers based on stereospecific catalysts and the new warehouse facilities are included in this section of the budget.

It is now evident that the efforts of increased costs of material, services, and labor, as well as the large production capacity in the United States and the output of new European synthetic rubber manufacturing plants, will continue to exert an influence on long-range plans in Sarnia. Polymer feels that the projects included in this budget along with expanded efforts in marketing and research will maintain its competitive position in the world's rubber market.

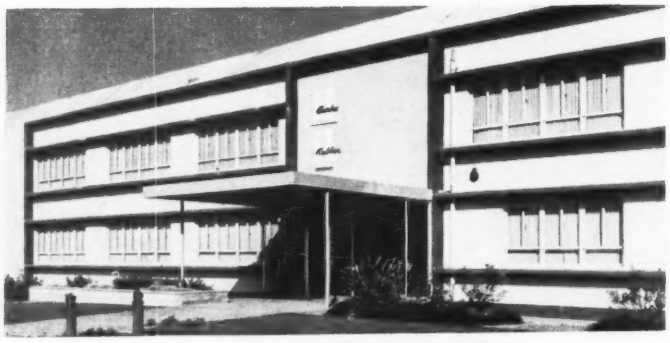
Dayton Rubber Expands Tire Plant and Sales

Tire manufacturing capacity at The Dayton Rubber Co., Dayton, O., is expected to be doubled during 1959. Reequipment of the big main plant there is already under way: the first of several mechanized conveyer lines has been installed, and new presses and tire-building machines are being delivered at regular intervals. When this project is completed this fall, Dayton Rubber will have a completely in-line tire production, with no lost motion, and with a high degree of automation.

To make room for the additional tire capacity, the firm is moving its mechanical goods production to a new multimillion-dollar plant now under construction in Springfield, Mo. New office facilities at Dayton for the tire division are also planned.

New district tire warehouses and retread plants for the firm are nearing completion at Portland, Oreg., and St. Louis, Mo. They bring to 11 the number of Dayton regional distribution centers. The extra tire making capacity is being added to keep up with the tire replacement market and to meet the demand of the company's new sales program.

The announcement of the expansion was made at the first nationwide conference of Dayton district managers. The managers, representing key market areas, were briefed on 1959 advertising and merchandising plans and procedure techniques, by company department heads.



Facade of Burke Rubber Co.'s main plant

Burke Adds New Wing

Burke Rubber Co. has added a new wing to its main manufacturing plant at 2250 S. Tenth St., San Jose 3, Calif. Increased volume of sales prompted the addition in order to provide continued economical production facilities. One feature is a completely separated and closed-off area for mixing and storing black stocks. One Banbury will be in the black mixing area and another Banbury in the colored mixing area.

The new construction is a tilt-up concrete construction, 14,000 square feet, which adds to the plant's present 54,000 square feet area. All manufacturing operations will now be performed in this one complete factory.

The company's main product divisions are: the flooring division which manufactures rubber and vinyl flooring products; and the industrial rubber goods division which has a complete line of molded mechanical products.

Norman Burke, vice president, designed the plant; Halsey Burke, executive vice president, announced the need of the addition because of increased sales. Virgil Price, manager, industrial rubber goods division, has broadened his sales outlets into many new product lines. Drace Kutnewsky, technical director, has expanded his staff and facilities to handle the increased volume of precision molding and specification work.

19th Million Bale Of Baytown MB Rubber

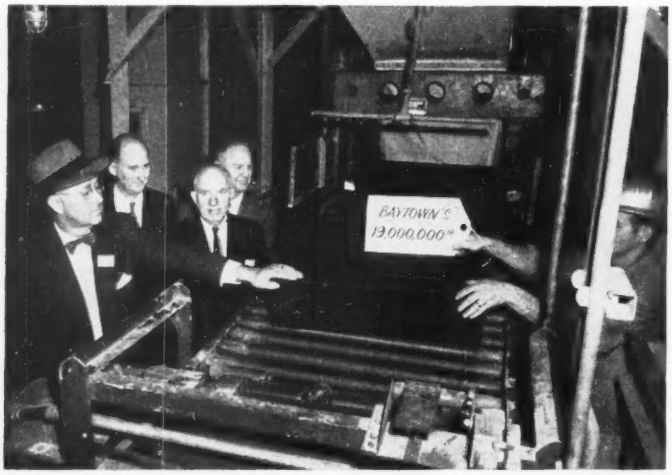
A production record has been set by the Baytown, Tex., plant of United Carbon Co.'s rubber manufacturing subsidiary, United Rubber & Chemical Co. On February 10 the plant produced the 19,000,000th bale of Baytown SBR black masterbatch.

United Carbon directors and officers were on hand to view the tagging of the 90-pound bale, and its presentation to United Rubber president, A. G. Treadgold, by Plant Manager T. Lyman. The officers and directors toured the plant, viewing production facilities and extensive new pilot-plant installations. The group, headed by Board Chairman S. C. Coleman and President R. W. French, was also briefed on United Carbon's research and development program.

Construction and equipping of the new pilot-plant facilities were expected to have been completed in February. A. G. Susie, research and development manager for United Rubber, and an officer of that subsidiary, termed the pilot-plant second to none in the industry.

The carbon black masterbatch production total achieved by the plant is far more than that of any other rubber plant engaged in such masterbatching, according to the company. Black masterbatching techniques were pioneered at this plant, and since 1945 such products have been manufactured exclusively. During the past year more than 30 types of masterbatches were produced on a commercial basis, including 12 new types not previously marketed.

Edward Elmer Ross



(Left to right) T. Lyman, S. Coleman, A. Treadgold, and R. French viewing the 19,000,000th bale of Baytown SBR black masterbatch

New Ashley President

T. C. Ashley & Co., Inc., Boston, Mass., an 87-year-old New England chemical distributor and agency, has announced a change in ownership by the election of Edward Elmer Ross to president and treasurer and sole stockholder. Thomas W. Ashley, former president, will continue with the company as a director and as manager for the sale of Vulcoil, a vulcanized vegetable oil that the company has sold to the rubber industry for 50 years.

Prior to joining the Ashley company, where he served several years as a technical representative and sales manager, Ross was an industrial chemist with Naugatuck Chemical Co. and the Hercules Powder Co. and a research administrator at Massachusetts Institute of Technology.

Leopold F. Bornstein

National Polychemicals Forms Plastics Unit

National Polychemicals, Inc., Wilmington, Mass., in a new expansion move has formed a plastics division, according to E. V. Osberg, president. General manager of the new division and vice president of the company is Leopold F. Bornstein, formerly vice president and technical director of Synvar Corp., Wilmington, Del., for the past 16 years.

Dr. Bornstein contributed greatly to the founding of the Polish plastics industry and has been internationally active in plastics. He brings to National Polychemicals 30 years' experience in this field.

Born in Krakow, Poland, Dr. Bornstein received his education at the University of Prague in Czechoslovakia. He is a member of the American Chemical Society, Society of Plastics Engineers, Association for the Advancement of Science, Forest Research Society, Technical Association of the Pulp & Paper Industry, and the Chemists' Club of New York.

National Polychemicals was founded in Boston six years ago and now operates a multi-unit chemical plant on its 65-acre site in Wilmington, Mass. The firm manufactures and sells organic chemicals and compounding materials utilized by the rubber, plastics, and related industries. The formation of the new division will open up new marketing areas for the firm.

Solid Fuels Research At Naugatuck Lab

Research on solid fuels, propellants for military rockets and missiles, will be conducted by United States Rubber Co. in a new laboratory nearing completion at its Naugatuck Chemical Division's main plant, Naugatuck, Conn. The new laboratory, about nearing completion, will be used primarily for company-sponsored research on solid fuel components. For the past three years, Naugatuck Chemical has been experimenting in this field. Work has so progressed that separate research facilities were needed.

Solid fuels, which employ specialty synthetic rubbers and plastics, could open a new era in transportation, according to a company spokesman. These super fuels are potential power sources for tomorrow's rocket-age commercial aircraft, as well as being vital to our country's defense.

The new laboratory will have approximately 1,000 square feet of floor space and is a one-story brick and steel structure. It will contain necessary equipment to make and test the new fuels on a small scale, also extensive safety equipment.

Solid fuels, basically, are a mixture of an oxidizing agent and a plastic or a synthetic rubber. The rubber or plastic is a binder and also burns. The oxidizing agent supports accelerated combustion. The advantages of solid fuels include simplicity, ease of storing, safety, and instant readiness.

Naugatuck Chemical, in addition to its own projects, is doing research on solid fuel materials under contract with the U. S. Naval Ordnance Department, and the new research facilities will be utilized for this work.

Firestone's New Plant For Coral and Diene

The Firestone Tire & Rubber Co., Akron, O., recently announced that it will build the world's first plant for the production of synthetic Diene and Coral rubbers. Both Firestone products, Diene[1] is a partial replacement for natural rubber, and Coral[2] is a complete replacement.

The plant, which will have an annual capacity to produce 30,000 tons of either product, will be an addition to the company's petrochemical center in Orange, Tex. Both rubbers can be produced in the same plant. Firestone will be able to switch from production of one to the other as demand requires.

Coral rubber is the synthetic equivalent of natural rubber; its principal constituent is isoprene. Coral rubber may be used in any application where natural rubber is now used, according to the company.

Diene was developed more recently by Firestone as a rubber extender; its principal raw material is butadiene. Butadiene, like isoprene, is a by-product of petrochemical operations; however, the supply of butadiene is plentiful, that of isoprene is not.

The production of Diene is expected to make the supply of natural rubber go twice as far, since Diene and natural can be combined in equal quantities without the loss of natural qualities, according to Firestone. Coral, of course, can be used entirely to replace natural rubber.

[1] RUBBER WORLD, Aug., 1958, p. 761.
[2] *Ibid.*, July, 1956, p. 549.

Shell Development Co. Adds Two Departments

Two new research departments have been created at Shell Development Co.'s Emeryville (Calif.) research center. They are the synthetic rubber department, headed up by N. R. Legge; and the thermoplastics department, of which F. E. Condo will be acting department head. The new departments result from a division of the polymer and chemical applications department.

Dr. Legge joined the Emeryville research staff in 1955 as a research supervisor and became assistant department head—polymer and chemical applications—last year. Dr. Condo started with Shell in 1943 as a chemist. He was promoted to research supervisor in 1952 and to assistant department head in 1955. He has been acting department head—polymer and chemical applications—for the past year.

Also, Frank M. McMillan, head of the organic chemistry department at the Emeryville research center, has taken over the newly created position of manager of research and development for Shell Chemical Corp.'s plastics and resins division, New York, N. Y. He has been with Shell for more than 20 years, having begun in the research center as a chemist in 1937.

N. R. Legge

Reeves Bros. Strong In Industrial Fabrics

During the last year Reeves Brothers, Inc., New York, N. Y., a leading textile manufacturer, announced four significant developments: (1) first commercial production of a satisfactory Hypalon covered nylon fabric, called Coverlight-H; (2) first commercial production in the United States of polypropylene yarns; (3) development of the largest line of offset printing blankets on the market; and (4) first American production of oriented nylon strip, used as a strengthening layer in power belting.

Reeves Brothers, founded in 1920, reorganized its textile production and started a diversification program around 1950 to open new markets. As a first step of the program, the firm acquired the Brooklyn plant of Vulcan Products, Inc., as well as an offspring of Vulcan, making gas meter diaphragms. Reeves consolidated the entire production of Vulcan products in a new plant in Buena Vista, Va. This Vulcan Rubber Products division makes synthetic rubber coated fabrics, offset and newspaper blankets, synthetic diaphragms, and other industrial fabrics. The firm's plastics division, started in 1947, makes polyethylene and polypropylene yarns and weaves, as well as a number of other plastic products, such as nylon rod and strip.

Reeves Brothers has developed a total of nine different blanket grades of rubber-coated blankets for offset printing and publishing, sold under the names Durofyne and Duroflex. Under the name of Coverlight-N (for neoprene) and Coverlight-H (for Hypalon), the Vulcan Rubber Products division manufactures and sells two high-quality lines of synthetic rubber-coated nylon fabrics. These products are used as protective coverings for trucks, equipment, boats, silage, etc. Under the name of Reevecote, this division makes almost 100 different grades of industrial coated fabrics for use in air, bearing, and transmission seals; cable wrappings; carburetor diaphragms; gaskets; insulation; vapor conservation balloons; and other industrial products.

In 1953, under the name of Reevon, the company brought out a new linear polyethylene filament with considerably improved properties over its polyethylene yarns first extruded in 1947. These yarns today are stabilized against the effects of ultra-violet light; have an improved abrasion resistance, higher softening and yield points, and a tenacity of more than three times the value obtained before 1953.

Reeves weaves Reevon yarn into an open-mesh ultra-violet stabilized polyethylene fabric, designated Pooltex, which has been patented for use in manufacturing swimming pool covers. Lighter than water (polyolefins are lighter than water), the fabric floats. Completely impervious to water, it does not increase in weight by absorbing water; consequently it never requires drying.

In 1958, Reeves was first company in the United States to produce commercially another polyolefin fiber—polypropylene. This material is suitable for many applications where polyethylene is presently used, but a few different properties promise additional markets for the newer fiber.

Reevon yarns are extruded at the company's Fairmont, S. C., plant. This plant also manufactures a number of other plastic products such as nylon tubing, rod, and strip. The oriented nylon strip, called Reevestrip, is used primarily as a component in the manufacture of power transmission and conveyor belts. The use of nylon strip in narrow, flat transmission and V-belts is currently being investigated. The company has also begun production of non-oriented nylon strip, which is used as a material for gaskets, washers, bearing seals, and other similar products.

Kleinert's Breakfast

Over a thousand notions buyers and merchandise managers attended Kleinert's annual notions breakfast February 3 at the Hotel Sheraton Astor, New York, N. Y. Richard M. Bleier, vice president in charge of sales, stated that daytime network TV programs will be used by the company this spring to promote its notions items and swim caps, the first TV advertising of notions. The firm will sponsor NBC's Truth or Consequences and The County Fair.

Howard P. Abrahams, formerly sales promotion manager of the National-Retail Merchants' Association, stressed the importance of store tie-ins with TV advertising. He is now vice president in charge of retail sales at the Television Bureau of Advertising. He pointed out that 86% of the people in an average marketing area have TV sets.

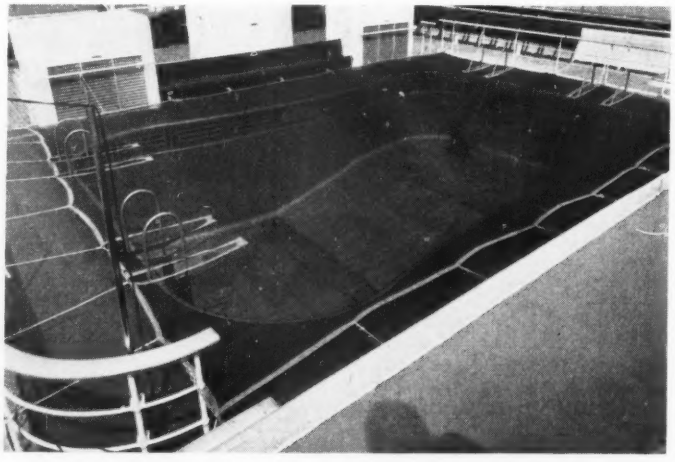
Carl Lindemann, director of daytime programing, NBC Network, also spoke.

Firestone's Officers

At the annual stockholders' meeting of The Firestone Tire & Rubber Co., Akron, O., January 24, the following nine directors were reelected: Harvey S. Firestone, Jr., Lee R. Jackson, Raymond C. Firestone, James E. Trainer, Leonard K. Firestone, Roger S. Firestone, John J. Shea, Harvey H. Hollinger, and Joseph Thomas.

At the meeting which followed the stockholders' meeting the following officers were reelected: Harvey S. Firestone, Jr., chairman; Mr. Jackson, vice chairman; Raymond C. Firestone, president; Mr. Trainer, executive vice president; Mr. Thomas, vice president and secretary and general counsel; other vice presidents: Mr. Hollinger, Harold D. Tompkins, Harold M. Taylor, John L. Cohill, Earl B. Hathaway, Joseph A. Meek, Louis J. Campbell; treasurer, Elton H. Schulenberg; comptroller, Claude A. Pauley; assistant treasurer, Elden H. Eaton; assistant secretaries: Henry S. Brainard and Byron H. Larabee; and assistant comptrollers: Laurence A. Frese, Robert P. Beasley, and Lee R. Shannon.

At this meeting Mr. Shea announced his retirement as vice president and chairman of the finance committee. Shea, an executive with 51 years service with Firestone, has been an officer and director of the company for 37 years. He will continue as a member of the board of directors.



Reeves' Pooltex fabric (woven polyethylene yarn) is used in this cover for the swimming pool of W. R. Grace's liner, *Santa Rosa*

American Enka To Buy Brand Company

American Enka Corp. has agreed to purchase in all-cash transaction William Brand & Co., Inc., Willimantic, Conn., which produces diversified types of plastic covered wire and cable for the electronics, business machine, communications, aircraft, guided missile, electric, and allied industries, according to a joint announcement by John E. Bassill, president of Enka, and Alfred Brand, president of the Brand company.

American Enka, with plants in Enka, N. C., and Lowland, Tenn., manufactures rayon and nylon for textile and industrial uses and is one of the largest producers of Tyrex viscose tire yarn. The acquisition of the Brand company is the second step in a diversification program started by Enka in 1957. Last year it acquired The Rex Corp., West Acton, Mass., another producer of wire, cable, and insulating material for the communications and electronics industries.

The Brand company was organized in 1920 as an importer of electrical insulating materials. It was one of the first suppliers to the radio, television, and business machine fields. A manufacturing plant opened in Will mantic in 1939 produces varnished tubing and sleeving, extruded plastic tubing, plastic insulated wires and cables, radio circuit hook-up wire, aircraft and coaxial cables.

The Brand company also operates a new plant in North Windham, Conn., which is currently being expanded. In 1957 a wholly-owned subsidiary was organized in Santa Monica, Calif., to serve the aircraft and missile industries. Altogether, the company employs 400 persons.

A research program carried out by Brand for the development of improved materials and superior insulating techniques will be stepped up in coordination with the extensive research facilities of American Enka. The Brand business will continue to operate under its present management, which is headed by Alfred Brand, son of the firm's founder.

NEWS BRIEFS

THE LOS ANGELES RUBBER GROUP, INC., RUBBER TECHNOLOGY FOUNDATION *at the University of Southern California, L. A., is offering a $3,500 fellowship* for full-time research work in the field of rubber or elastomers for one year toward an M.S. in Chemical Engineering.

Applicant should have a B.S. in Chemical Engineering and some courses in the field of elastomers or equivalent experience. Send application, including courses taken and grades, or request for further information to: Dr. E. G. Partridge, director, TLARGI Rubber Technology Foundation, University of Southern California, Los Angeles 7, Calif.

SMITH, SCHERR & McDERMOTT, *industrial design firm organized in 1946, has opened its new studios at 39 S. Miller Rd.*, Akron 13, O. Current clients include The Hoover Co., Perfection Industries, The Tappan Co., Rubbermaid, Inc., and the International Cooperation Administration of the United States Government.

HEWITT-ROBINS, INC., *has announced that its foam products division has reorganized its sales department,* centralizing control of the entire operation at the firm's general offices in Stamford, Conn. This move, designed to enable the company to adapt itself more quickly to changing market patterns, will also help gear Hewitt-Robins for the expected large increase in consumption of foam products in the 1960's. A customers' service department has been established at Stamford, headed by M. J. Ihrig. Also, Charles A. Maher has been named to the newly created position of manager of field sales, with headquarters in Stamford. He will be responsible for direction of foam sales.

B. F. GOODRICH TIRE CO., *a division of The B. F. Goodrich Co., Akron, O., is now marketing a new six-volt replacement battery for a number of foreign cars* sold in the United States. Designated Pow-R-Pak (P-18M), it fits the 1956-57 MG, 1957 Opel, 1955-57 Volkswagen, 1956-57 Austin Healey, 1950-54 XK-120 Jaguar, and 1955-57 HK-140 Jaguar. The new size gives BFG a replacement battery for most foreign cars sold in the United States. Pow-R-Pak batteries incorporate the latest developments in grid metal and plate materials for resistance to the harmful effects of overcharge.

GOODYEAR TIRE & RUBBER CO., *Akron, O., has developed a "luxury" rubber for tires, named Plioprene.* The company claims that this modified SBR will provide a softer ride with less squeal, vibration, road rumble, and highway expansion joint thud. Research, development, and testing have been taking place over many months and will continue to try to improve the tread wear characteristics which are not so good as those of some other synthetics, according to the announcement. The Plioprene is being produced in limited amounts in the company's SBR plants without requiring changes in existing equipment.

AMOCO CHEMICALS CORP. *has moved its export marketing department to new offices at 555 Fifth Ave., New York 17, N. Y.* The move is designed to give its customers easier, more direct, and rapid contact with the company. The department is headed by Robert Kirk, who has long been active in international sales. *Also, Amoco is represented by Dr. A. J. Skey, who headquarters in London, England.* Amoco's products include petroleum additives, solvents, hydrocarbon resins, aromatic resins, aromatic plasticizers and chemical intermediates.

THE PIONEER RUBBER CO., *Willard, O., has redesigned its popular laminated handyman's gloves, called "Pioneers."* The line now features a tailored fit construction in both the knit-wrist and gauntlet styles. By lengthening the fingers and tapering the sides of the gloves, to keep them from becoming too loose on the hands, a more comfortable fit has been achieved. Some of the original design features are retained: soft-nap cotton twill lining, flexible liquidproof Pylox coating, and resistance to oils, acids, caustics, greases, and solvents.

U. S. INDUSTRIAL CHEMICALS CO.'S *polyethylene plant at Tuscola, Ill., has just come on stream with an initial capacity of 25 million pounds per year.* The new plant will compound Petrothene polyethylene resin with carbon black and other additives to produce electrical and pipe resins. Production from the new plant will support U.S.I.'s efforts to expand sales of polyethylene for use in electric wire insulation and plastic pipe. U.S.I. is a division of National Distillers & Chemical Corp., New York, N. Y.

News Briefs

SHELL CHEMICAL CORP. *has announced the initial production from its market development unit, built at Martinez, Calif.* The unit, costing about $2 million, is designed to produce semi-scale quantities of the more promising industrial chemicals from its research activities. The first run of products included several derivatives of acrolein. The various combinations of the different reactors and purification systems make the unit capable of producing a wide range of products in capacities that range from 1,000 pounds to tank-car quantities.

UNITED STATES RUBBER CO., *New York, N. Y., has introduced a new tread rubber for passenger-car and light truck tires* that is said to cure in 35% less time than regular tread rubber. The faster curing time of the new tread rubber, called U. S. Royal Speedster, makes possible more cures with the same equipment, shop space, power, and shop overhead. Made of 100% cold synthetic rubber, U. S. Royal Speedster gives good performance and mileage, and it can be cured in either steam or electrically heated equipment of all types, according to the rubber company. It has a guaranteed shelf life of 90 days and is available in sizes up to 18/32-inch in thickness and a maximum base width of 11 inches.

B. F. GOODRICH TIRE Co., *a division of the B. F. Goodrich Co., has started construction on a new major warehouse and office in Pittsburgh, Pa.* The new facility, which will serve large parts of Pennsylvania, New York, West Virginia, and Maryland, will accommodate upward of 50,000 tires, and the site is adequate to allow for a 50% expansion when needed, according to C. S. Stone, Pittsburgh zone manager. The building will be completed late in April.

GENERAL ELECTRIC CO.'S *silicone products department, Waterford, N. Y., has opened a new sales territory, with an office at 2375 Hampton Ave., St. Louis, Mo.* Frank C. Janda, sales representative, takes charge of this new territory. He had previously served as a sales representative in the department's Chicago district.

ENDURA CORP., *Quakertown, Pa., will complete in late 1959 an integrated program of expansion and modernization* which includes a new 60-inch impregnating system expected to increase capacity by more than 25%. Previously Endura, a supplier of pressure-sensitive paper tape backings, has been producing only to customer specifications. Now the firm is bringing strength in depth of experience in research and development on rubber and synthetics.

MONSANTO CHEMICAL CO.'S *plastics division has announced that the production capacity of its high-pressure polyethylene plastics facilities at Texas City, Tex., will be increased to 100 million pounds a year.* Completion of the project is scheduled for the third quarter of this year. The expansion is designed to speed the commercialization of several significant high-pressure technical advances. High-pressure polyethylene is widely used for film, sheet, wire insulation, cable jacketing and pipe, as well as for bottles and molded products. Linear polyethylene has proved superior where heat resistance, greater stiffness, and improved barrier properties are needed, it is said. Polyethylene is expected soon to be the first billion-pounds-a-year plastic.

MOBAY CHEMICAL CO., *Pittsburgh, Pa., has disclosed plans for a 50% expansion of production capacity for tolylene diisocyanate,* one of the basic chemicals used in the manufacture of urethane foam cushioning and insulating materials, elastomers, and industrial coatings. This will be the second major incremental expansion of Mobay's plant at New Martinsville, W. Va., since it went on stream in 1956 and will increase the capacity of its TDI facilities to 18 million pounds a year. A similar 50% expansion was completed by Mobay in 1958. Mobay, a jointly owned associate company of Monsanto of St. Louis and Farbenfabriken-Bayer of Germany, was formed in 1954 as a basic supplier of urethane chemicals.

BRISTOL MFG. CORP., *Bristol, R. I., has appointed a styling committee* composed of company executives and headed by Dan Rosenberg, St. Louis sales representative, and Sal Gianola, in charge of its pattern department. This committee has been operating on an informal basis for more then 60 days. Being first to introduce pointed-toe canvas footwear and pointed-toe gaiters for women was the factor behind the appointment and indicated that Rosenberg and Gianola should continue to guide the styling of the company's lines.

PRESSURE BLAST MFG. CO., INC., *Manchester, Conn., has designed and shipped a new wet-blast unit for the elimination of hand-cleaning in the maintenance of tire molds to Pirelli, S.p.A., Milan, Italy.* Molds to be cleaned are taken directly to the wet-blast unit without prior finishing and cleaned to basic metal in approximately one-third the former time required. The cleaning medium is a fine mesh abrasive, suspended on water and impelled by compressed air. Details of operation and construction are available from the company.

AMERICAN CYANAMID CO. *has broken ground at Bound Brook, N. J., for a multi-million-dollar anthraquinone manufacturing facility* which will double the firm's annual production of this chemical. At this plant Cyanamid will also provide additional production capacity for making methyl anthraquinone, naphthoquinone, and phthalic anhydride. Methyl anthraquinone is used in making dyes and in processing drying oils, and phthalic anhydride is used to make dyes, pigments, rubber chemicals, and alkyd resins for surface coatings. The new unit will be operated by the company's organic chemicals division.

B. F. GOODRICH CHEMICAL CO., *a division of The B. F. Goodrich Co., is installing a fully automatic vinyl chloride monomer production unit at its Calvert City, Ky., plant.* The installation will be the first in the chemical processing field to utilize this revolutionary digital system to operate a chemical process specifically designed for computer control. Feature of the unit is the RW-300 system, engineered by The Thompson-Ramo-Wollridge Products Co., which will exercise closed loop control over the process and will log operating data and compute values, maximizing the efficiency of the production unit.

UNITED STATES RUBBER CO.'S *Naugatuck, Conn., footwear plant has set a new world's safety record for all manufacturing plants of the rubber industry.* The old record of 11,400,483 manhours without a lost-time accident or disabling injury—held by U. S. Rubber's Mishawaka, Ind., plant—has now been passed by the 5,000 employes of the footwear and general products plant in Naugatuck. They have operated the plant accident-free since September 27, 1957, according to W. M. Graff, safety director for the company. Employes of the Naugatuck plant, which has a record of shoemaking going back 115 years, expect to pass the 12,000,000 manhours mark shortly.

J. O. ROSS ENGINEERING DIVISION, *Midland-Ross Corp., has moved its Chicago offices* into the company's new suburban building at 370 S. School St., Mt. Prospect, Ill. The Hartig extruder division, Midland-Ross Corp., and the John Waldron Corp., a subsidiary of Midland-Ross, have also moved their Chicago offices into the new building. Located in Weber's Industrial Park, the modern air-conditioned building has approximately 12,500 square feet of floor space, and the site provides for future building additions. Leslie Janett heads up the Ross division; while Ralph Palm and Gordon Tigney direct the Waldron machinery and coupling departments.

ST. REGIS PAPER CO., *New York, N. Y., and* MONSANTO CHEMICAL CO., *St. Louis, Mo., have announced the formation of the* FOME-COR CORP., a jointly owned company which will manufacture and market Fome-Cor, a unique foamed plastic and paper sandwich material. W. R. Adams, president of St. Regis, said that the investment is another step in the St. Regis program to develop new materials and markets in the paper and container fields. Monsanto's investment is part of a broad program to develop new applications for plastics, particularly in combination with other materials, said C. A. Thomas, president of Monsanto. Fome-Cor consists of foamed plastic and paper laminated by a continuous process into a new and versatile material which retains high compression strength under severe moisture conditions, provides good insulation and cushioning properties, and is light in weight. It is capable of a broad range of uses for containers, displays, stage settings, etc.

B. F. GOODRICH TIRE CO., *a subsidiary of The B. F. Goodrich Co., Akron, O., has announced that nearly one million small boat carriers have been built by professional trailer manufacturers since 1946,* and about 177,500 are expected to be built during 1959. The boat trailer industry has accounted for upward of $10 million in tire sales to date, not accounting for the tires on home-made trailer rigs. The tire company estimates that about 1.6 million boat trailers are now in use in the United States.

NOPCO CHEMICIAL CO.'s *plastics division has broken ground for construction at North Arlington, N. J., that will triple the size of the present plant,* provide six times the capacity for making polyurethane flexible foams, and permit expanding facilities for foamed-in-place systems. Polyurethane foam consumption during the past three years has grown thusly: 1956, 8-10 million pounds consumed; 1957, 12-18 million pounds; 1958, 25-40 million pounds, and estimates for 1959, 70 million pounds.

THE BARR RUBBER PRODUCTS CO., *Sandusky, O., is now producing balloons in Day-Glo daylight fluorescent pigments* under the trade name "Barr-Glo." The company indicates that the brilliance of the colors give the balloons a good market appeal. They are available on cards of all types and in bulk.

UNITED STATES RUBBER CO., *New York, N. Y., and* NITTO TIRE CO., *Tokyo, Japan, have announced that the Japanese Government has approved a technical service agreement* under which U. S. Rubber will supply technical assistance to Nitto for the production of all types of pneumatic tires and tubes. Under the terms, Nitto will also produce U. S. Royal brand tires for export sale by U. S. Rubber. This agreement will provide the rubber company with a base for expanded business in Asia. At the same time it will also provide Nitto with new and modern production techniques and product designs.

NEWS about PEOPLE

Gerard W. Brooks has been appointed to the newly created post of director of marketing for the tire division of United States Rubber Co., New York, N. Y. He was formerly president of South Bend Tackle Co., Inc. He will direct marketing activities for all tires and allied products sold by the division. In addition to U. S. Royal, Fisk, and Gillette brands, the company also makes tires for a number of private-brand companies and is a large supplier of original-equipment tires to the automotive industry.

Hans Wolfhard, an expert in physics and combustion research, has joined the research staff of Thiokol Chemical Corp.'s reaction motors division, Denville, N. J., as manager of the physics department. Dr. Wolfhard will be responsible for the technological advancement of the division in the field of physics. Previously, he had served as a research scientist attached to the Chief of Division of Explosives Technology, U. S. Bureau of Mines, as well as acting as consultant to the General Motors research center and to the University of Pittsburgh.

R. A. Jones has been made sales manager, molecular sieves, at Linde Co., division of Union Carbide Corp., New York, N. Y. He was manager of market development for this new product since 1957. These molecular sieves, tiny crystalline zeolites, have found use as carriers for catalysts used in the rubber industry.

George Harkins has been named manager of industrial relations, and **Russell E. Hanna** has been made the new personnel manager of Seiberling Rubber Co., Akron, O. These two moves follow the announcement that **James K. MacDougall,** industrial relations director, will leave the company on March 15. Also, **Paul V. Rosenberger,** factory employment manager, will become manager of standards; and **Robert Dinkelman,** manager of methods and standards, will take over as employment supervisor under Hanna.

Robert W. Woollen has been promoted to assistant treasurer and manager of the accounting department of Petroleum Chemicals, Inc., New Orleans, La. He succeeds the late **A. L. Green, Jr.,** who had been comptroller until his recent death. Woollen joined PCI in January, 1957, as budget officer and was made assistant treasurer in October, 1957, a post he will continue to hold in addition to managing the accounting department.

Laurence H. Finley, purchasing agent at the Los Angeles plant of The B. F. Goodrich Co. since 1953, has been named operating manager of the company's purchasing division, with headquarters in Akron, O. He joined BFG in 1943 in the physical testing laboratory. Following Navy service, he took part in a purchasing training program and in May, 1948, was named purchasing agent of the BFG plant in Tuscaloosa, Ala.

Frank A. Magno has been appointed assistant manager of the New York, N. Y., sales office of Godfrey L. Cabot, Inc., effective January 1. He moves to this position from sales-service representative for the midwestern area of the special blacks department.

Fabian Bachrach

L. H. Finley F. A. Magno

News about People

William W. Scull

V. E. Wulff

William W. Scull, with The B. F. Goodrich Co., Akron, O., since 1929, has been elected vice president-manufacturing. He has been BFG director of manufacturing services since 1954 and director of purchasing and traffic since 1952. In his new position he continues to have responsibility, at corporate staff level, for purchasing, traffic, raw materials planning, engineering design and construction, machine development, time study and methods, industrial engineering, and safety. He is president of B. F. Goodrich Malaya, Inc., a natural rubber latex processing company in Malaya and Singapore, and also is president of B. F. Goodrich Liberia, Inc., the company's rubber plantation operation in Africa.

V. E. Wulff has been promoted to manager of rubber purchases for The Firestone Tire & Rubber Co., Akron, O., and **D. J. Burson,** who had been operating assistant and assistant buyer in rubber purchasing, has been appointed rubber buyer for the company. These promotions are the result of the recent appointment of **J. C. Roberts** to president of the Synthetic Rubber & Latex Co. and director of rubber purchases of the parent company.

H. W. Stainsby has been appointed production manager of the Borden Chemical Co. (Canada) Ltd. He joined the Canadian affiliate of the Borden Chemical Co. in 1957 and now will be responsible for production of the company's industrial adhesives, coatings, and building materials.

H. Wolfhard and **H. J. Rose** are now associate general managers, and **John Latsh** general sales manager for United Rubber, a new footwear marketing division within Dominion Rubber Co., Ltd., Montreal, P.Q., Canada. The division will have three separate operating units, each with its own sales organization, as follows: Dominion footwear, **J. J. Gilfillan,** sales manager, Northern Woodstock, **G. A. Clifford,** sales manager; G. P. footwear, **A. E. Ruthven,** sales manager. **C. B. Parsons** will be associated with the new division in a senior management capacity.

Avrom I. Medalia has been made head of the fundamental research section, carbon black technical department, Godfrey L. Cabot, Inc., Boston, Mass. Dr. Medalia was formerly senior research chemist of the organic and polymer section, new products research department.

A. I. Medalia

Ferd Muller

Ferd Muller, of Montclair, N. J., becomes a sales representative in eastern United States for the Falls Engineering & Machine Co., Cuyahoga Falls, O. He will devote his time to the firm's roller die cutters in the New England States, New Jersey, eastern New York, and eastern Pennsylvania.

Bruce A. Gustin, Jr., George S. Cooper, Jr., Theodore J. Hamilton, and **James R. Retter** have been promoted by Union Carbide Chemicals Co., division of Union Carbide Corp., New York, N. Y. Gustin, formerly district manager for the Boston area, has been made eastern division manager. Cooper, previously a technical representative in the New York district, has been advanced to assistant district manager, New York district. Hamilton, promoted to district manager of the Albany district, was previously a technical representative in the Philadelphia district. Retter, formerly the Albany district manager, has been promoted to district manager of the Boston district.

Edmund S. Burke, president, The Kelly-Springfield Tire Co., Cumberland, Md., has been elected chairman of the board of directors. **George B. Newman,** executive vice president, has been elected president and chief executive officer, succeeding Burke. Burke's experience in the rubber industry dates from 1911. He was named president of Kelly-Springfield in 1935.

Leonard R. Brice has been named director of employe relations for the Dayton Rubber Co., Dayton, O. He was formerly director of industrial relations for The Black-Clawson Co., Hamilton, O. He has a background of more than 20 years in all phases of personnel and industrial relations work.

C. A. Stiegman

C. R. Conklin

Chris A. Stiegman, formerly technical director, has been promoted to the corporate position of director of research for Hooker Chemical Corp., Niagara Falls, N. Y., reporting to **Thomas E. Moffitt,** president. Dr. Stiegman will be in charge of all research at the corporate level, embracing both chemical and plastics research. He will also be responsible for both the patent and product development departments at Niagara Falls. Also, **J. Howard Brown,** formerly manager, Niagara research and development since 1957, has been named general manager-chemical research; **Alvin F. Shepard,** resident director of the Leroy, N. Y., laboratory of the Durez Plastics Division, becomes general manager—plastics research; and **James F. Sconce,** formerly technical assistant to management, has been appointed technical assistant to the director of research.

C. R. Conklin becomes assistant general sales manager of the Republic Rubber Division, Lee Rubber & Tire Corp., Youngstown, O. He succeeds **J. M. Hughes,** who resigned March 1. Conklin joined Republic in August, 1926, as a salesman in the Philadelphia and Baltimore areas. During World War II, he was stationed in Washington, D. C., as a special representative, and in November, 1947, was appointed eastern district manager of the company. Hughes has been with Republic since July, 1949. He started as sales promotion manager and subsequently served as sales development manager, manager of distributor sales, and assistant general sales manager.

Howard Sides has been elected assistant secretary and assistant comptroller by the board of directors of Texas Butadiene & Chemical Corp., Houston, Tex.

V. F. Giulitto has been appointed senior sales engineer in the rubber and rubber chemicals department, The Goodyear Tire & Rubber Co., Akron, O. He will be responsible for sales service activities relating to the chemical division's nitrile rubber, Chemigum. Previously he had been assigned to produce development compounding.

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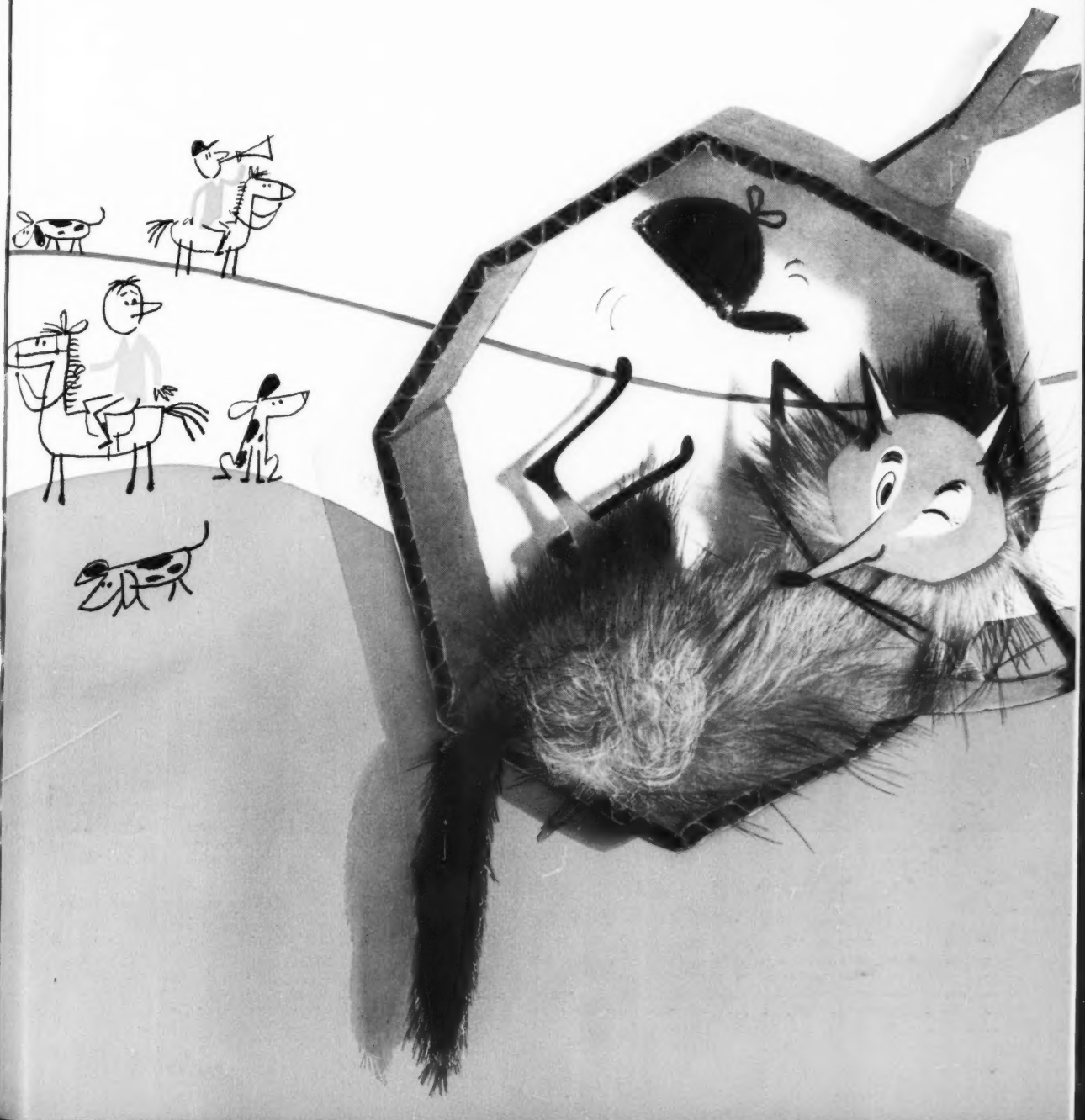

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Fabian Bachrach

W. M. Parsons H. P. Donahue, Jr.

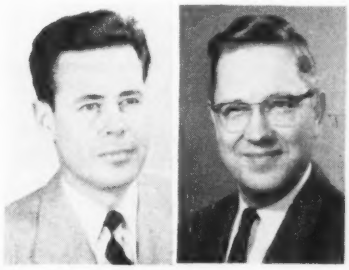
Henry P. Donohue, Jr., has been appointed eastern sales manager of non-ceramic industries, and **Frank E. Daley,** eastern ceramic sales manager in the sales department, minerals and chemicals division, Godfrey L. Cabot, Inc., Boston, Mass. **Warren M. Parsons** will be western sales manager of non-ceramics, and **Frank J. Zvanut,** western ceramic sales manager. Donohue formerly was product manager for Cab-O-Sil in the minerals and chemicals division. Daley, Parsons, and Zvanut had been with the sales department of this division.

Amory Houghton, Jr., staff vice president and a director of Corning Glass Works, Corning, N. Y., has been elected to the board of directors of The B. F. Goodrich Co., Akron, O. Houghton is also a vice president and a director of Corning Glass Works of Canada, Ltd., and of 719 Fifth Avenue Corp.; a director of Dow Corning Corp.; Pittsburgh Corning Corp.; Sylvania - Corning Nuclear Corp.; and the Empire State Chamber of Commerce.

Joseph V. Rizzo has been placed in charge of a new southeastern sales territory of the silicone products department of General Electric Co. Until a new sales office is established, he will be located in the silicone sales office, 1000 Tuckaseegee Rd., Charlotte, N. C. He previously was a sales representative assigned to the Newark, N. J., office.

R. W. Fitzgerald, formerly sales manager of the tire division, The Goodyear Tire & Rubber Co., becomes western trade sales manager with responsibility for the central, midwestern, and western regions for the division. **Coy F. Stroud,** manager of the southern sales region, is now eastern trade sales manager, with responsibility for the eastern, southern, and southwestern regions, headquartering in Akron, O. **Charles A. Eaves, Jr.,** manager, petroleum sales department, has been named assistant to the vice president, responsible for the petroleum sales division and for special marketing and merchandising problems.

E. R. Behnke has been appointed manager of molecular sieve products of Linde Co., division of Union Carbide Corp., Tonawanda, N. Y. Formerly sales manager of these new materials, he will be responsible for sales, production, and technical development, with headquarters at the company's new products laboratory. Linde molecular sieves are being used in the curing of rubber and plastic materials.

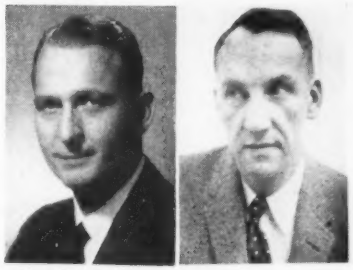


E. R. Behnke S. Richardson

Spencer M. Richardson has joined Endura Corp., Quakertown, Pa., as research chemist. With 16 years of intensive research and development experience on rubber, latex, and foam rubber, he will work in new-product and new-process development to create new latex impregnated and coated specialty papers.

Joseph C. Caprino has been appointed sales engineer for the Chicago district of the silicone products department, General Electric Co. Previously he had served as a specialist in rubber market development for the department at Waterford, N. Y. **Leonard J. Sacks** has been made sales representative for the eastern district of the department, with headquarters in Philadelphia, Pa. He succeeds **David Clark,** who has been appointed a specialist in market development at department headquarters, Waterford. Also **Royal V. Mackey, Jr.,** has been named representative for the upstate New York territory, headquartering at Waterford. He succeeds Mr. Sacks.

Robert Taylor, formerly production manager, has been named factory manager at Firestone Tire & Rubber Co. of Canada, Ltd., Hamilton, Ont., Canada. With Firestone 35 years, he has been production manager at the plant since 1945. **Alfred Horrax,** since 1951 chief engineer of the Hamilton plant, now succeeds Taylor as production manager. **C. R. Strand,** staff engineer at Plant 2, Akron, O., goes to Canada as chief engineer. The promotions, effective February 1, have been made in view of the forthcoming retirement May 1, of **J. H. Forman,** vice president in charge of production since 1943 and a director of the Canadian company since 1945.



Fabian Bachrach

Don C. Miller Gene Albert

Don C. Miller, formerly senior vice president of Kenyon & Eckhardt, Inc., advertising agency, has been elected vice president-marketing of The B. F. Goodrich Co., Akron, O. Joining Kenyon & Eckhardt in its Detroit office in 1948, Miller was agency executive, assigned to the Lincoln-Mercury account, and vice president of the Detroit office before being transferred to New York in 1956. He was elected senior vice president and became a principal stockholder in the agency in 1956, was elected to the executive committee in 1957, and supervised the development of major marketing plans for principal clients. Before his association with the agency, he was director of market research and head of sales organization and analysis department of Packard Motor Co.

Gene Albert has been named assistant product manager for the Vulcan Rubber Products division, Reeves Brothers, Inc., N. Y. He will be concerned primarily with market development of the broadened Vulcan line, which includes offset and newspaper blankets, synthetic rubber-coated nylon fabrics, gas meter diaphragms, and other industrial fabrics.

David H. Bechtold has been appointed a technical sales representative for plasticizer sales for Monsanto Chemical Co., in the Cleveland, O., area, effective March 15. A district sales representative for the company in this area since 1953, he will get intensive training at the company's plasticizer application research laboratories in St. Louis. Following this, he will join **Peter W. Spink** and **Walter F. Waychoff** in carrying out technical liaison with customer's for Monsanto's more than 70 plasticizers.

Charles B. Putnam, treasurer of the B. F. Goodrich Textile Products division, Thomaston, Ga., since 1953, has been named manager of costs and interplant accounting for the B. F. Goodrich Tire Co., a division of the B. F. Goodrich Co., with headquarters in Akron, O. He replaces **William F. Spaethe,** who transferred to replacement tire sales on special assignment.

News about People

C. T. Schieman, Jr.

T. J. Fontelieu

C. T. Schieman, Jr., southern region manager, has been appointed sales manager for the silicones division, Union Carbide Corp., in the general office in New York, N. Y., in charge of customer sales activities. **T. J. Fontelieu,** director of silicone rubber sales in the eastern region, was appointed southern region manager, Atlanta, Ga., succeeding Schieman.

Derrill D. Copeland has been named assistant manager of retread and repair materials for The Goodyear Tire & Rubber Co.'s retreading and equipment sales division, Akron, O. He succeeds **Robert L. Martin,** now district sales manager in Peoria, Ill.

John P. Seguin has been elected vice president of Alco Oil & Chemical Corp., Philadelphia, Pa. Since starting with the firm in 1953 he was a sales representative servicing the sales of latex compounds and rubber chemicals in the New England area. **Roger B. Gookin** becomes a sales representative headquartering in the company's Providence, R. I., office. **Daniel L. Worth** has been named to represent the company in the South from a new regional office to be located in or near Greenville, S. C. **Thomas C. Holst** has been made a technical sales representative for the sales and application of latex compounds and chemicals for the textile, paper, and adhesive trades; while **Richard J. Mahoney** has joined Alco as a member of the sales service laboratory.

James E. Faulkner, of Akron, and **A. G. Lund** of Harbel, Liberia, have been named vice presidents of Firestone Plantations Co., a subsidiary of The Firestone Tire & Rubber Co., Akron, O. Also, Lund was named president of the United States Trading Co., a Firestone subsidiary which operates throughout Liberia. **John J. Verboom,** also of Harbel, was named vice president of the trading company. The appointments are effective immediately. Faulkner will remain at the Akron headquarters, and Lund, at the company's rubber plantation in Liberia.

Francis X. O'Keefe has joined the administrative sales staff of National Polychemicals, Inc., Wilmington, Mass. He was formerly with Wasco Chemical Co., where he was assistant to the sales manager.

A. E. Hosier

A. R. Cox

Albert E. Hosier, director of research and development, has been appointed to the newly created post of technical director, The Faultless Rubber Co., Ashland, O. **Alvon R. Cox** succeeds Hosier as director of research and development. Others on the technical staff are **Elton Whitted,** chief chemist; **Don Lowe,** supervisor, dipped goods; **Robert Roebuck,** supervisor, sponge; and **Robert Butler,** supervisor, pharmaceutical and biological products. Hosier, who joined Faultless in 1935, has been responsible for a number of contributions to material compounding and product testing. In his new post he will have compete responsibility for all laboratory activity and will coordinate the technical aspects of the firm's operation with sales and production. Cox, in his new position, will have supervision over product research and material compounding, as well as development of consumer products and those used in industry.

Earl D. Gunn has been appointed vice president and elected a director of B. F. Goodrich Sponge Products Canada, Ltd., Waterville, P.Q., Canada. He succeeds **M. Frank Fitzgerald,** named managing director of BFG operations in Brazil. Previously Gunn had been manager of manufacturing for sponge and plastic operations. Fitzgerald had been purchasing agent and production manager at the Canadian plant and in 1956 was made vice president and general manager.

Edwin V. King, Jr., becomes staff associate, and **Theodore W. Heiskell, Jr.,** has joined the development department, Union Carbide Chemicals Co., division of Union Carbide Corp., South Charleston, W. Va. King will conduct technical surveys and collaborate on operations analysis projects. Heiskell will work in the quality control laboratory.

R. M. Waples

A. J. McMullen

Robert M. Waples has been elected chairman of the board of The Garlock Packing Co., Palmyra, N. Y. He succeeds **George L. Abbott** who is retiring as board chairman, but will remain as a director and as chairman of the executive committee. **A. J. McMullen,** a vice president, has been named president, Waple's former post, as well as principal executive and administrative officer of the company, which is one of the world's largest manufacturers of packings, gaskets, and seals. McMullen has been a director and vice president of the firm since 1955. Waples joined Garlock in 1915 and in 1927 was named manager of the sales and service division at Palmyra. He was elected secretary in 1929, vice president in 1948, executive vice president in 1952, and president in 1955.

J. Chester Ray, director of customer relations for the tire division of United States Rubber Co., New York, N. Y., retired, effective February 1, after a career of 49 years with the company. He started as a stockroom boy in the Pittsburgh branch in 1909 and rose to be one of the top sales executives in the tire division. He never worked for any other company, and his long service with the U. S. Rubber was interrupted only during the two world wars. One of the most widely known figures in the tire industry, Ray became associated with the tire division in 1929 after holding several sales posts in the rubber sundries and footwear divisions and after having been named manager in 1922 of the branch that gave him his start.

Robert O. Nellums, Lowell L. Fellinger, and **Donald L. Eby** have been appointed assistant directors of the engineering department, organic chemicals division, Monsanto Chemical Co., St. Louis, Mo. Nellums will assume management of the department's engineering development section. Fellinger and Eby will continue to manage project sections in the department. Each of the assistant directors, in addition to managing his section, is expected to participate in perfecting operations of the engineering department as a whole and in improving engineering within the division.

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Sun Oil Company custom-refines *seventeen narrow-specification* Rubber Process Oils for the rubber industry. Each one is designed to fit a special need for product quality or economy.

THE TABLE ON THE RIGHT gives some facts about six of Sun's most widely used Rubber Oils. Others, not listed, include a series of paraffin oils with low aromatic content; naphthenic oils with moderate aromatic content; and Sundex oils with high aromatic content.

IF YOU PROCESS	USE	BECAUSE
Light-colored oil-extended polymers (1703, 1708, etc.)	**CIRCOSOL® NS**	It combines superior nonstaining characteristics with best processibility, imparts good physicals. Primarily an extender.
Oil-extended polymers (1703, 1708, etc.)	**CIRCOSOL 2XH**	It's a general-purpose softener and extender for light-colored rubber goods, especially where optimum physicals are required.
Regular neoprenes, natural rubber, Hypalon (where color is a problem)	**CIRCO® LIGHT**	It's an ideal all-around moderate-priced plasticizer for nonstaining reclaims and butyl inner tubes, SBR, GN, W, WRT.
Oil-extended polymers (1705, 1710, etc.) and natural rubber, Hypalon (where color is no problem)	**SUNDEX® 53**	It's a double-distilled aromatic plasticizer for tire-tread stock, rubber footwear, matting, toys, semi-hard rubbers, high-Mooney WHV.
Black master-batch polymers 1706, 1711, 1712, etc.	**SUNDEX 1585**	It's a new highly aromatic plasticizer for tough polymers where easy processing is desired. This is a distilled process aid.
Natural rubber, SBR polymers, regular and WHV neoprenes, acrylonitrile polymers	**SUNDEX 85**	It's especially recommended for very high loadings of WHV neoprene (from 75 to over 100 parts Sundex 85 to 100 parts polymer). Used in hard rubber goods.

- To help you select the correct oil for your individual needs Sun has just published a new brochure: "A GRAPHIC METHOD FOR SELECTING OILS USED IN COMPOUNDING AND EXTENDING BUTADIENE-STYRENE RUBBERS."

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News about People

James M. McNamee has been appointed sales manager of the petrochemicals department, American Cyanamid Co., New York, N. Y.; while **L. L. Seivard** has been named director of research-organic pigments for the company's pigments division. Dr. Seivard will be responsible for research and development of new colored pigments. He has been with Cyanamid since 1952, when he joined the company as a development chemist. He became chief chemist for the organic pigments manufacturing department in 1957.

Harold W. Francis has been appointed treasurer of The Kelly-Springfield Tire Co., Cumberland, Md., according to **G. B. Newman,** president. Francis is past president of the Akron Chapter, American Institute of Banking and, until this appointment, served as treasurer of the Akro Club. **William H. Oburn, Jr.,** has been named vice president in charge of finance and operating of Kelly-Springfield. He came to the firm as treasurer in January, 1958, from Goodyear-Mexico, the Mexican subsidiary of Goodyear International Corp. Prior to that assignment, Oburn held various positions in Goodyear over a period of 17 years of service.

Kenneth G. MacMurray has been named sales development manager of Schenectady Varnish Co., Inc., Schenectady, N. Y. In his new position, he will be responsible for the market research, product development, and sale of the company's polyester, phenolic, terpene and terpene phenolic resins for use in adhesives, rubber compounding, and emulsion polishes. He will continue in his present capacity as export manager.

Gavin A. Taylor has been named assistant manager of the export division of Enjay Co., Inc., New York, N. Y., petrochemicals marketing firm. Taylor, a veteran in the synthetic rubber field, has served on rotational assignment for the past 10 months as manager of export sales—Europe, spending most of that time in Western Europe and North Africa.

Douglas Mueller, assistant to the president at Seiberling Rubber Co., Akron, O., has been elected president of the board of trustees of Barberton Citizens Hospital, Barberton, O. He has been a member of the hospital board since 1952, serving as its vice president during the past year.

Albert J. Jones has been appointed to the new position of inventory controller for the Dunlop Tire & Rubber Corp., Buffalo, N. Y. He will coordinate production schedules with sales requirements to provide service to the sales organization and will be responsible for establishing all inventories and the distribution of all Dunlop tires, tubes, foam rubber, and sporting goods products. **R. Kirk Jones** has been named traffic and transportation manager succeeding the late **Urban C. Fischer.** Jones has been with the company 16 years.

Duncan Douglass becomes operations manager, sales service, of B. F. Goodrich Canada, Ltd., Kitchener, Ont., Canada. For the past number of years he was general sales manager of the B. F. Goodrich Chemical Co. **J. Charles Pavanel** now has been appointed sales manager of that organization.

W. L. Weske becomes assistant sales manager for Canada for General Tire & Rubber Co. of Canada, Ltd., Welland, Ont., Canada.

John W. McGovern, president of United States Rubber Co., has been elected to the board of directors of Irving Trust Co., New York, N. Y. Associated with U. S. Rubber throughout his business career, he was named a director in 1951, executive vice president in 1956, and was elected president and chief operating officer in 1957.

John E. Bassill, president of American Enka Corp., New York, N. Y., since 1950, has submitted his resignation to take effect after the annual meeting on April 22. His successor will be elected at that time. Bassill took a leading part in the formation of Tyrex, Inc., the industry organization which certifies and promotes the new Tyrex viscose tire yarn.

Charles F. Pfeifer has been appointed vice president in charge of the Panta-Pak division of The Pantasote Co., Passaic, N. J. He is a former sales manager of the film division of Olin-Mathieson Corp.; vice president of Jim Nash Associates; and former vice president of Standard Packaging in charge of product and package development.

S. G. Fearman has been named director of manufacturing sales services for the Goodyear Tire & Rubber Co. of Canada, Ltd., New Toronto, Ont., Canada. He will be in charge of a new grouping of divisions dealing with all raw materials and physical distribution of finished products including purchasing, merchandise distribution, traffic and export, and a new warehousing and shipping division.

Obituary

James G. Park

James G. Park, retired vice president of Enjay Co., Inc., New York, N. Y., passed away on January 29 at his home in Bronxville, N. Y. He had retired last July after 38 years' service with the petrochemicals marketing firm.

Mr. Park began his career as a sales trainee in 1920 and later spent three years in Brazil selling petrochemicals. Subsequently he was recalled to the firm's New York headquarters and later was promoted to sales manager of chemical products. He was named a vice president in 1938.

Mr. Park was born in Brooklyn on March 14, 1896. He received bachelor and master degrees in chemistry from Brooklyn Polytechnic Institute. During World War I he served overseas for 22 months.

A frequent contributor of articles to technical journals, he belonged to numerous scientific associations, including the American Chemical Society, American Institute of Chemists, and the Society of the Chemical Industry. He was also organizing president of the Chemical Market Research Association and a past president of the Yonkers (N. Y.) Board of Education.

Funeral services were held February 2 at the Reform Church, Bronxville, and interment was at Woodlawn Cemetery, Bronx, N. Y.

He is survived by his wife and a daughter.

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Commodity Exchange

(*Continued from page 896*)

second term as president. Rousselot is the tenth president to serve the Commodity Exchange since it was founded in 1933.

Other officers elected were: vice presidents, Timothy F. Carberry, president, Metal Traders, Inc., representing the metals group; Matthew S. Fox, of Balfour, Maclaine, Inc., for rubber; Walter S. Stern, president, H. Elkin & Co., for hides; J. Raymond Stuart, general partner, E. F. Hutton & Co., representing the commission house group; and John McN. Sullivan, president, Gerli International Corp., for the silk group.

Joseph Fischer, of Joseph Fischer & Co., was reelected treasurer of the Exchange.

New governors elected to the board for a three-year term were: William J. Deevy, Jr., president, Schmoll Fils-Deevy Corp.; Mr. Carberry; Henry Mintz, Herman Hollander, Inc.; William Reid, general partner, Bache & Co.; and Joseph Louis, president, L. Littlejohn & Co.

NEWS from ABROAD

British Rubber Producers' Research Association 1957 Annual Report

Although natural rubber products have been extensively studied for well over half a century, they are still amenable to important improvement as to quality, L. Bateman, research director of the British Rubber Producers' Research Association, remarks in his introduction to a review of activities during 1957, which appeared in the BRPRA's twentieth annual report, recently come to hand. This observation is borne out by several of the 17 scientific studies summarized, including work on:

1. NON-RUBBER CONSTITUENTS OF LATEX. Progress is described on separation and analysis of polynucleotides—constituents of living cells which have a vital role in metabolic processes of trees, which in turn influence growth, latex yield, and quality and resistance to disease.

2. GRAFT POLYMERIZATION. New methods make it possible to control distribution of polymerized methacrylate—bound or free—within individual latex particles.

3. MECHANO-CHEMICAL REACTION OF RUBBER AND ALLIED POLYMERS. New possibilities for chemically modifying rubber, and a new method of making block-copolymers have resulted from the recognition that mechanical treatment tears high polymer molecules apart into fragments with highly reactive free radical ends.

4. MIXING AND MASTICATING MACHINES. A masticator and a mixer, specially designed for laboratory processing in connection with the above have been developed and are being commercially produced.

5. VULCANIZATION STUDIES. New insights into the cross-linking mechanism have led to work on preparing novel vulcanizates with unconventional cross-links. Chloro, epoxy, carboxyl, and carbethoxy derivatives of natural rubber have been prepared, and cross-linking methods investigated; elastic and aging properties of some of these products are being examined.

6. FUNDAMENTAL CHEMISTRY OF OXIDATIVE AGING. Not the sulfides themselves, but the oxygenated derivatives formed in very small quantities initially, are antioxidants in accelerated sulfur vulcanizates. Highly sensitive qualitative methods of analysis have been developed to study their preparation and reactivity, especially in connection with oxidative chain scission.

7. STRESS RELAXATION STUDIES OF OXIDATIVE AGING. Stress relaxation techniques were used in a study of dithiocarbamates as aging inhibitors in natural rubber vulcanized by peroxides or tetramethylthiuram disulfide—TMTD

8. TEAR BEHAVIOR. Changes in tear quality due to internal viscosity are deduced from second-order transition temperature for modified rubber.

9. REINFORCEMENT. Electron microscopy of ruptured surfaces of carbon black-filled rubbers reveals that the rupture path is not straight, but proceeds tortuously from one filler particle to another, which condition seems to explain black reinforcement. The crucial importance of rubber-particle adhesion is also brought out.

10. ABRASION. Resiliency as a factor in abrasion of tires has been studied.

11. OZONE CRACKING. Butyl and certain other synthetic elastomers owe much of their superior ozone resistance to high internal viscosity. Antiozonants are being studied on the basis of characterization of ozone cracking by a critical stress and a rate of crack growth.

12. HEAT-RESISTANT NATURAL RUBBER COMPOUNDS. The knowledge that the good heat-resisting properties of natural rubber vulcanized with TMTD in presence of ZnO and absence of sulfur is due mainly to the presence of zinc dimethyldithiocarbamate formed during vulcanization has been applied to developing heat-resistant natural rubber mixes. Such an improved compound, further protected by a special combination of anti-agers, gave results indicating that for service at 100° C. it compares favorably with SBR and neoprene.

13. NATURAL RUBBER FOR LOW-TEMPERATURE SERVICE. So-called "Crystallization-Inhibited Rubber," or C-I rubber, is found to retain flexibility at temperatures down to —60° C. better than three SBR rubbers, and also to have better elastic properties and tension set. Treatment of natural rubber latex with small amounts of organic thiolacids and special plasticization are responsible for this superiorty. C-I compounds have been developed for the government and certain manufacturers, for such applications as flexible tracks for Arctic vehicles and aircraft instrument mountings.

14. SUPERIOR PROCESSING RUBBER.

15. RUBBER IN ENGINEERING.

16. RUBBER IN ROADS. Chlorinated rubber-tar mixtures for road surfacing are to be reinvestigated.

17. LATEX TECHNOLOGY. Work on latex concentrates with low ammonia content continues. A latex preserved with 0.2% ammonia, 0.2% boric acid and 0.05-0.1% of a colloid stabilizer has been developed by the Rubber Research Institute of Malaya and is being tested in Britain and the United States. A study of the aging of latex film revealed that thiourea and certain of its derivatives are excellent antioxidants for unvulcanized rubber.

The last part of Dr. Bateman's review concerns activities of rubber technical developments in connection with rubber-bonded non-woven fabrics; polyglycol HS-35/40 heat-sensitized latex; liquid rubber and pilot-plant preparation of modified rubbers. Each of the various sections ends with a list of papers recently published or about to be published on the subject treated, as well as related patent applications.

Malaya

Wage Dispute Settled

The year-old negotiations between employers and the union over a new wage system were finally concluded when, thanks largely to the intervention of G. L. Wilkinson, Commissioner for Industrial Relations, new agreements replacing those of 1956, were signed on February 7. A settlement had almost been reached a month earlier, but the question of the duration of the agreement caused a deadlock.

The new system guarantees a basic wage; the price of rubber is still a factor, but the average for one month instead of for three months is the normal base. An incentive-pay scheme has been introduced, and the cost of living allowances have been retained. Time and one-half will be paid for work on the seventh day.

The basic daily wage for tappers is $2.20 (Straits) when the average monthly price for rubber is 60-70 cents a pound, and $2.00, if between 60 and 50 cents. With every rise of

10 cents over 60-cent average, an additional 14 cents daily will be paid. If the price average remains under 50 cents, or over $1.60 for three consecutive months, the agreement over tappers' wages may be suspended, and wages will be paid as for the 50-60, or $1.50-$1.60 price zone, according to circumstances. The standard task of 450 trees per tapper is abolished. The new plan divides estates into three classes: A—areas planted with high-yielding trees during and after 1936; B—those so planted before 1935; C—estates with unselected or poor trees. Class A areas will pay tappers 6 cents extra for every pound over 15 pounds brought in; the rate in B areas is 8 cents for every pound over 11 pounds, and in C areas, 10 cents for every pound over 6 pounds. To discourage rubber thefts, tappers will get 4 cents for every pound of wet scrap brought in.

For male field workers, the daily wage ranges from $2.15, with price average of 40-60 cents, up to $4.00, with average $1.40-$1.60. Female workers get 4/5 of these rates.

The agreement is to run for a year, starting next June; the delay is necessary to allow time for explaining the system to managers and workers throughout the country.

1958 Production Hits Eight Year High

Rubber production in Malaya during 1958 was the highest in eight years, totaling 663,624 tons, almost 4% above the 1957 figure. The record production during December undoubtedly contributed toward this result; at 71,676 tons, output for that month was 38.6% above that for November. The previous record was 69,878 tons, in December, 1950. A substantial increase in December crop had been expected since there were few morning rains, so that tapping could be carried out throughout the month and for the most part in the early part of the day when the flow of latex is highest. Furthermore, trees had been rested in November because the rainy weather in that month interfered with tapping. At the same time, the results of replanting as a factor here are not discounted.

The share of smallholders in 1958 output came to 272,747 tons, an increase of more than 1% over last year's results; that of estates was 390,877 tons, almost 6% above the 1957 amount.

Russian Demand Rating

The Financial Times of London, discussing trends recently, editorially stated that Russia has lately been the mainstay of the natural rubber market and concluded its remarks by saying that if during the current year there is no recovery in Western demand, she will remain the dominating factor.

Local rubber men are not all inclined to accept this view. The president of the F.M.S. Chamber of Commerce, H. B. Hussey, is quoted as saying: "The Russian demand is always unpredictable. They come in unexpectedly, and that is one of the reasons for the slight market fluctuations. But I would not consider that Russia has been the mainstay of the rubber market here."

Even without Russia, he continued, supply and demand would balance because prospects were favorable for natural rubber. He considered that the present price level is reasonable, and that every pound of rubber produced would be sold.

At the same time, speculation as to the reason for Iron Country interest in natural rubber continues. Some suggest that Russia is stockpiling; another—possibly indulging in wishful thinking?—opines that Iron Curtain countries are not sufficiently advanced in production of synthetic rubber.

Rubber Research News

Ammoniated *Hevea* latex can be used to initiate polymerization of vinyl monomers, work in the chemical division of the Rubber Research Institute of Malaya has indicated. Natural rubber latex contains an amine which in the presence of hydroperoxide will induce polymerization of vinyl monomers.

B. C. Sekhar[1] describes tests showing that polymerization of vinyl monomers can be initiated by specially prepared natural rubber latices. In one test, the amine naturally present in latex caused polymerization of 85-90% of methyl methacrylate monomer to which cumene-hydroperoxide had been added.

It was shown that peroxidation takes place in ammoniated latex on standing or agitation in presence of oxygen, resulting at ambient temperature in the production of active centers on the polyisoprene. These active centers have hydroperoxide properties and can polymerize vinyl monomers in presence of a reducing system.

The amounts of amine naturally present in latices from different sources vary considerably, and this variability is reflected in the polymerization efficiency of different clonal latices; similarly, variability is noted in the capacity of latex to undergo peroxidation in air.

The implications of these observations for graft polymerization are to be discussed in a further study. It is meanwhile suggested that the findings reported in the present article could provide a basis for measurements of amine content and peroxidation of latices.

[1] *J. Rubber Research Inst. Malaya,* Vol. 15, Part IV (1958).

SP Masterbatches

B. C. Sekhar and W. Drake describe[1] the preparation of dry and wet masterbatches of SP (Superior Processing) rubber and how they may be used to impart superior processing characteristics to all grades of rubber. The dry vulcanized rubber masterbatch has been developed as a compounding aid to manufacturers and can be blended with any grade of rubber with the aid of normal mixing equipment. It is recommended when SP RSS 2, 3, 4, and 5 grades are needed. The wet process is suitable only in producing areas for SP remilled or scrap grades exclusively.

On the economic side, it appears that the additional cost of the dry masterbatch process, including depreciation of capital equipment and packing charges to England, comes to 7.59 cents (Straits) per pound, and it is suggested that a reasonable price, including overheads and profits, would be 11 cents over the price of RSS 1. The position is more favorable for the wet process for remilled grades, where additional costs work out at 4.97 cents, and the suggested price above RSS 1 is 7 cents. The dry process, however, has the advantage that it is not limited to remilled or scrap grades, but can be used for any grade.

It is pointed out that while the additional costs of the lower-grade SP rubbers may appear high, there are several hidden advantages which only actual experience in a factory shows up. These rubbers have better physical properties than the normal material of the same grade; rate of mill breakdown is improved, and cleanliness and color are better.

1958 Rubber Exports Top One Million Tons

Preliminary official statistics put total 1958 rubber exports from the Federation of Malaya and Singapore at 1,080,656 tons, an increase of nearly 8% over exports in 1957. High as this figure is, it was still exceeded by the record shipments of 1,155,267 tons in 1951 and 1,106,499 tons in 1950.

The 1958 totals include imports into the Federation, from all sources, of 42,197 tons and of 371,127 tons into Singapore, in all 413,324 tons, or 13½% more than in 1957. As usual, most of the imports were from Indonesian countries to Singapore, and

(Continued on page 934)

ENJAY BUTYL

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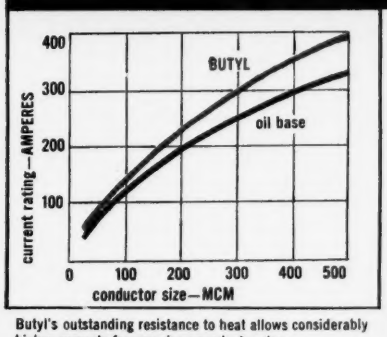

Butyl's outstanding resistance to heat allows considerably higher currents for any given conductor size.

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MARKET REVIEWS

Natural Rubber

During the January 16-February 15 period the natural rubber futures market showed an appreciable rise; the strength was attributed to reactivation of Iron Curtain countries' buying plus the good rubber consumption figures anticipated for January.

When the market did dip, towards the end of the period under review, the decline was probably due to the sell-off in the stock market. Other factors influencing the drop were: (1) curtailment of production at the Chrysler plants occasioned by the Pittsburgh Plate Glass strike; (2) Buick lay-offs; (3) an apparently temporary cessation of Iron Curtain country buying in volume which brought on liquidation on the part of speculators.

A New York brokerage firm predicted that if nearby rubber contracts close above 31¢ a pound, a further rise to the 34¢ level could occur. The report points out that year-end stocks in the United States were down to a low level of 75,000 tons. Admitting the difficulty of an accurate forecast of Soviet purchases and the use of synthetics, the study looks for growing economic strength in Western Europe and greater demand in the United States. On this basis, world year-end stocks could be about 275,000 tons, an unacceptably low total, the report notes. It concludes that at least an improved price structure can be expected and at the most a very substantial rise.

January sales, on the New York Commodity Exchange, totaled 9,950 tons, compared with 6,770 tons for December contract. There were 21 trading days in January, and 19 during the January 16-February 15 period.

On the physical market, RSS #1, according to the Rubber Trade Association of New York, averaged 30.29¢ per pound for the January 16-February 15 period. Average January sellers' prices for representative grades were: RSS #3, 29.37¢; #3 Amber Blankets, 27.70¢; and Flat Bark, 22.30¢.

REX CONTRACT

	Jan. 23	Jan. 30	Feb. 6	Feb. 13
Jan.	30.25	—	—	—
Mar.	30.45	29.85	30.60	30.25
May	30.35	29.93	30.60	30.25
July	30.35	29.88	30.60	30.25
Sept.	30.25	29.88	30.60	30.25
Nov.	30.20	29.88	30.60	30.25
1960				
Jan.	30.10	29.88	30.60	30.25
Mar.	—	29.80	30.55	30.25

NEW YORK OUTSIDE MARKET

	Jan. 23	Jan. 30	Feb. 6	Feb. 13
RSS #1	30.25	29.88	30.38	30.25
#2	29.75	29.38	29.88	29.88
#3	29.38	28.88	29.38	29.50
Pale Crepe				
#1 Thick	32.00	31.38	32.00	31.50
Thin	32.25	31.88	32.25	32.00
#3 Amber Blankets	27.88	27.75	28.50	28.75
Thin Brown Crepe	27.75	27.63	28.38	28.50
Standard Bark Flat	22.75	23.13	24.13	24.25

Synthetic Rubber

Two new records were set by the rubber industry in January, with new rubber consumption amounting to 141,020 long tons and synthetic rubber production totaling 108,473 long tons in the same period, according to the regular monthly report of The Rubber Manufacturers Association, Inc. The previous peak month for new rubber consumption was January, 1957, when 137,715 tons were used. Synthetic rubber production reached its previous high in October, 1957, at 106,401 tons.

Synthetic rubber consumption in January, 1959, amounted to 90,670 tons, as compared with the 85,428 tons used in December, 1958. Consumption in tons by types, as compared with December, 1958, was: SBR, 75,100, against 71,290; neoprene, 7,410, against 6,701; butyl, 5,360, against 4,897; nitrile, 2,800, against 2,540. Synthetic rubber amounted to 64.3% of the total new rubber consumed in January, as compared with the December ratio of 64.5%. Natural rubber consumption in January came to 50,350 tons.

Exports of synthetic rubber also increased in January to 17,550 tons, in contrast to the 16,825 tons sent abroad in December. The increases in exports were for the specialty rubbers only; while exports of SBR declined 102 tons from those for this rubber in December.

At the Chicago Rubber Group meeting of January 30 on SBRs it was emphasized the use of oil-extended SBR had grown to 50% of the total nonblack cold rubber and that renewed interest in black masterbatches could make these products the fastest-growing category of SBR production in the near future. The warning was sounded, however, that the number of minor variations in the present black masterbatch types, and their implications, should arouse producers and consumers to the need of standardization in nomenclature and types.

RUBBER WORLD is continuing to assemble information regarding both regular commercial and commercial SBRs carrying ASTM experimental numbers. A complete tabulation will be provided as soon as possible for the benefit of consumers and producers alike.

Scrap Rubber

Toward the close of the period under review (January 16-February 15) trading in the scrap rubber market somewhat slackened. Reclaimers, it was believed, have sufficient scrap inventories on hand as a result of recent buying activity. Mixed auto tires in the East were sold at $7 to $11 a ton, with the high side of the range applicable only on shipments to Buffalo. Synthetic butyl tubes were sold at 5¢ a pound in the East and 5.25¢ in the Midwest.

	Eastern Points	Akron, O.
	Per Net Ton	
Mixed auto tires	$11.00	$12.00
S. A. G. truck tires	nom.	15.50
Peeling, No. 1	nom.	23.00
2	nom.	20.00
3	nom.	15.50
Tire buffings	nom.	nom.
	(¢ per Lb.)	
Auto tubes, mixed	2.75	2.75
Black	5.75	5.75
Red	6.25	6.25
Butyl	5.00	5.25

Latex

Interest on drum latex has again been only on a moderate scale during the January 16-February 15 period, but nevertheless the differential between latex and dry rubber shows a slight increase reflecting a somewhat better feeling in the market. In the bulk market the position is largely unchanged.

Whether the better sentiment shown in drum latex will continue is at this stage difficult to say as the situation is uncertain. It does appear, however, that the rather heavy stocks of drum latex are gradually being cleared.

Consumption in the United States in December totaled 6,820 tons compared with 6,540 tons in November. The total United States consumption in 1958

CYANAMID RUBBER
Chem Lines

NO. 21 OF A SERIES Published by AMERICAN CYANAMID COMPANY, Rubber Chemicals Department, Bound Brook, New Jersey

Cure Rates Are Equal as Processing Safety Varies

An interesting fact was developed in our last *Rubber Chem Lines* (No. 20)—that the actual cure rates of Cyanamid's delayed-action accelerators are essentially identical though each offers a different degree of processing safety. In order of increasing delayed action, these accelerators are CYDAC, NOBS No. 1, NOBS Special and DIBS. The graphed data previously presented showed how these accelerators, activated with DPG, all reached full cure in approximately the same time after the commencement of vulcanization.

Tests on Unactivated Sulfenamides

Additional useful information has been developed for the compounder by further investigating the performance of these delayed-action accelerators *without* activation with DPG. The same typical tire tread compound (SBR 1600, a 50% HAF masterbatch) was used.

For purposes of comparison, data were taken at five-minute intervals in the early stages to define the cure characteristics as they developed. Tensile strength, taken as a measure of the state of cure, is plotted against cure time in Figure 1. The similar development of this family of curves is strong evidence that these accelerators provide essentially the same cure rates.

Effect of Activation Shown

The actual range of processing safety available in these Cyanamid accelerators varies considerably. The only difference in the tests previously reported and those outlined here is the presence of DPG as an activator for the sulfenamide accelerators. The effect on Mooney Scorch is illustrated below:

Mooney Scorch (MS) at 280° F

10-point rise above minimum

	0.85 Parts Accelerator 0.15 Parts DPG	*1.0 Parts Accelerator (No DPG)*
CYDAC	29	29.5
NOBS No. 1	41	42
NOBS Special	44	44
DIBS	52	56

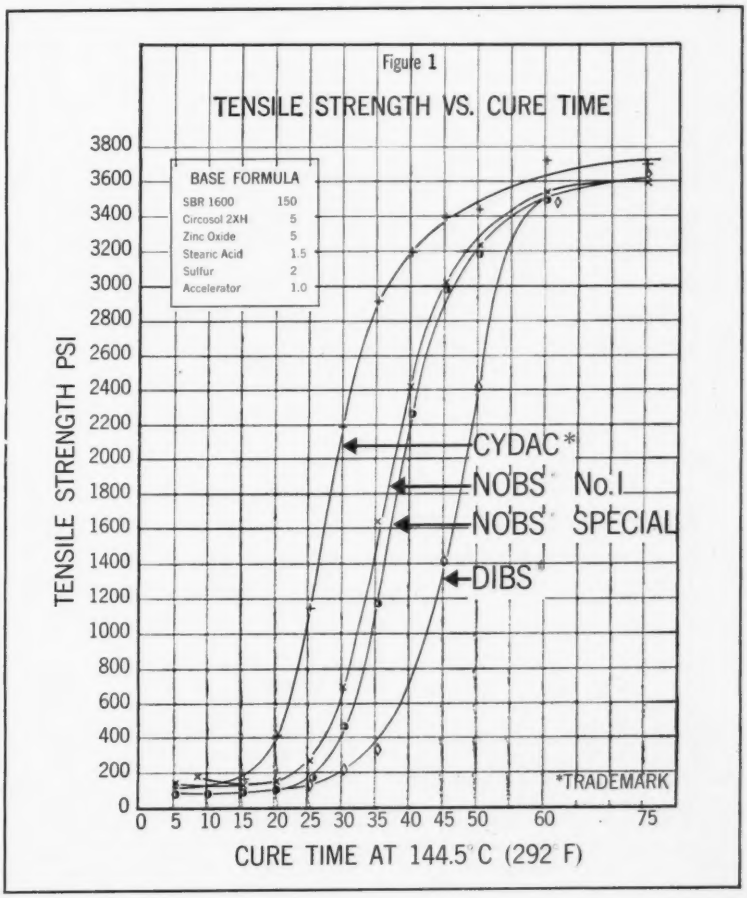
Greater freedom for the compounder is pointed up by these test results. The requirement for maintaining good cure rates and insuring satisfactory scorch protection can be simultaneously assured by the use of one of Cyanamid's delayed-action accelerators.

Trend to Greater Delayed Action

Particularly interesting to the compounder faced with the trend towards higher processing temperatures is the desirability of switching to accelerators in the "safer" range. The growing popularity of Cyanamid's NOBS and DIBS delayed action accelerators has made evident their usefulness in meeting current processing requirements while maintaining good curing rates.

Literature, samples and technical service on these accelerators are available from the Rubber Chemicals Department of American Cyanamid Company.

Figure 1


TENSILE STRENGTH VS. CURE TIME
BASE FORMULA
SBR 1600 150
Circosol 2XH 5
Zinc Oxide 5
Stearic Acid 1.5
Sulfur 2
Accelerator 1.0
CYDAC*
NOBS No.1
NOBS SPECIAL
DIBS
*TRADEMARK
TENSILE STRENGTH PSI
CURE TIME AT 144.5 C (292 F)
0 200 400 600 800 1000 1200 1400 1600 1800 2000 2200 2400 2600 2800 3000 3200 3400 3600 3800
0 5 10 15 20 25 30 35 40 45 50 60 75

amounted to 70,933 tons against 75,009 in 1957.

Prices for ASTM centrifuged concentrated natural latex, in tank-car quantities, f.o.b., rail tank car, ran about 37.75¢ per pound solids. Synthetic latices prices were 21.5 to 38.2¢ for SBR; 37 to 53¢ for neoprene; and 46 to 60¢ per pound for the nitrile types.

Final November and preliminary December domestic figures for all latices were reported by the United States Department of Commerce as follows:

(All Figures in Long Tons, Dry Weight)

Type of Latex	Production	Imports	Consumption	Month End Stocks
Natural				
Nov.	0	*	6,540	8,795
Dec.	0	*	6,820	8,900
SBR				
Nov.	7,307	—	6,009	7,810
Dec.	6,891	—	6,893	7,672
Neoprene				
Nov.	1,156	0	798	1,498
Dec.	986	0	805	1,563
Nitrile				
Nov.	1,205	0	1,108	2,530
Dec.	1,033	0	1,106	2,519

*Not available yet for period covered.

Reclaimed Rubber

The reclaimed rubber business continued good during January, and December, according to one company, was its best month since last October. Sales for February indicated that this month would be a very good month for reclaim sales.

According to The Rubber Manufacturers Association, Inc., report, January production of reclaimed rubber was 21,945 long tons; while consumption was 21,186 long tons.

Prices of reclaimed rubber during this period remained unchanged.

RECLAIMED RUBBER PRICES

Whole tire, first line	$0.11
Third line	.1025
Inner tube, black	.16
Red	.21
Butyl	.14
Light carcass	.22
Mechanical, light-colored, medium gravity	.155
Black, medium gravity	.085

The above list includes those items or classes only that determine the price basis of all derivative reclaim grades. Every manufacturer produces a variety of special reclaims in each general group separately featuring characteristic properties of quality, workability, and gravity, at special prices.

Industrial Fabrics

Industrial grey cotton goods were in an interval of marketing transition during the close of the period under review (January 16-February 15). Buyer interest in developments increased where the attitude had been indifferent. Such a change grew out of the desire to keep informed regarding factors associated with the mills' wage advance plans and the effect on prices and deliveries. Beyond this the buyer disposition continued on the sidelines regarding covering requirements through the April-June period.

Customers on numbered ducks were requisitioning mills to ship out against blanket orders. It appeared evident that users of numbered ducks had allowed yardage on hand to continue to diminish, but the changed primary market alerted them to carry again more than they had. This same development occurred in flat ducks.

Mills and commission houses agreed that the problem before them was to avoid precipitate steps such as too-eager selling efforts or too-sanguine price policies. Meanwhile, the firmer quotations, such as those listed below, of recent application, had begun to take hold in contracts.

Industrial Fabrics

Broken Twills*

54-inch, 1.14, 76x52	yd.	$0.52
58-inch, 1.06, 76x52		.585
60-inch, 1.02, 76x52		.5825

Drills*

59-inch, 1.85, 68x40	yd.	.365
2.25, 68x40		.2975

Osnaburgs*

40-inch, 2.11, 35x25	yd.	.2275
3.65, 35x25		.1525
59-inch, 2.35, 32x26		.275
62-inch, 2.23, 32x26		.2875

Ducks
Numbered Duck†

List less 45%

Hose and Belting Duck*

Basis	lb.	.60

Enameling Ducks*

	S. F.	D. F.
38-inch, 1.78 yd.	$0.3263	.3313
2.00 yd.	.275	.28
51.5-inch, 1.35 yd.	.45	.46
57-inch, 1.22 yd.	.4838	.50
61.5-inch, 1.09 yd.	.5413	.5538

Army Duck†

52-inch, 11.70 oz., 54x40 (8.10 oz./sq.yd.)	yd.	.5925

Sheeting*

40-inch, 3.15, 64x64	yd.	.2175
3.60, 56x56		.185
52-inch, 3.85, 48x48		.2275
57-inch, 3.47, 48x48		.235
60-inch, 2.10, 64x64		.36
2.40, 56x56		.31

Sateens*

53-inch, 1.12, 96x60	yd.	.565
1.32, 96x64		.52
57-inch, 1.04, 96x60		.615
58-inch, 1.02, 96x60		.625
1.21, 96x64		.5725

Chafer Fabrics*

14.40-oz./sq.yd. P.Y.	lb.	.67
11.65-oz./sq.yd. S.Y.		.61
10.80-oz./sq.yd. S.Y.		.61
8.9-oz./sq.yd. S.Y.		$0.67
40-inch, 2.56, 35x25		.25
60-inch, 1.71, 35x25		.435

*Net 10 days.
†2% 10 days.

Rayon and Nylon

The output of rayon tire cord and tire cord fabric during the fourth quarter of 1958 increased 20% from the previous quarter's level to 70,607 thousand pounds. During the same period the production of nylon tire cord and tire cord fabric increased 7% to 25,389 thousand pounds; while the production of cotton tire cord and tire cord fabric (excluding chafer fabrics) decreased 21%, according to the United States Department of Commerce.

Stocks of tire cord and tire cord fabric on January 3, totaled 38,187 thousand pounds, 1% above the September 27, 1958, level, but 14% less than the stocks on December 28, 1957.

Millions of autoists in United States and Canada and thousands of tire dealers in the two countries will be the targets of one of the biggest merchandising efforts in tire cord history this year. Tyrex, Inc., an association of five manufacturers of the super rayon cord named Tyrex is conducting the campaign. Publications with an estimated combined readership of 80 million will carry the story of Tyrex, which will be based on the theme, "More Tire Power." The ads will say that tires made with the new cord will provide the extra tire power because Tyrex is "pound for pound as strong as steel."

Total packaged production of rayon and acetate filament yarn during December was 57,500,000 pounds, consisting of 24,700,000 pounds of high-tenacity rayon yarn and 32,800,000 pounds of regular-tenacity rayon yarn. Production for 1958 totaled 635,700,000 pounds, consisting of 264,500,000 pounds of high-tenacity rayon yarn and 371,200,000 pounds of regular-tenacity rayon yarn. Production for 1957 had been: total, 714,300,000 pounds, including regular-tenacity rayon yarn, 373,500,000 pounds, and high-tenacity rayon yarn, 340,800,000 pounds.

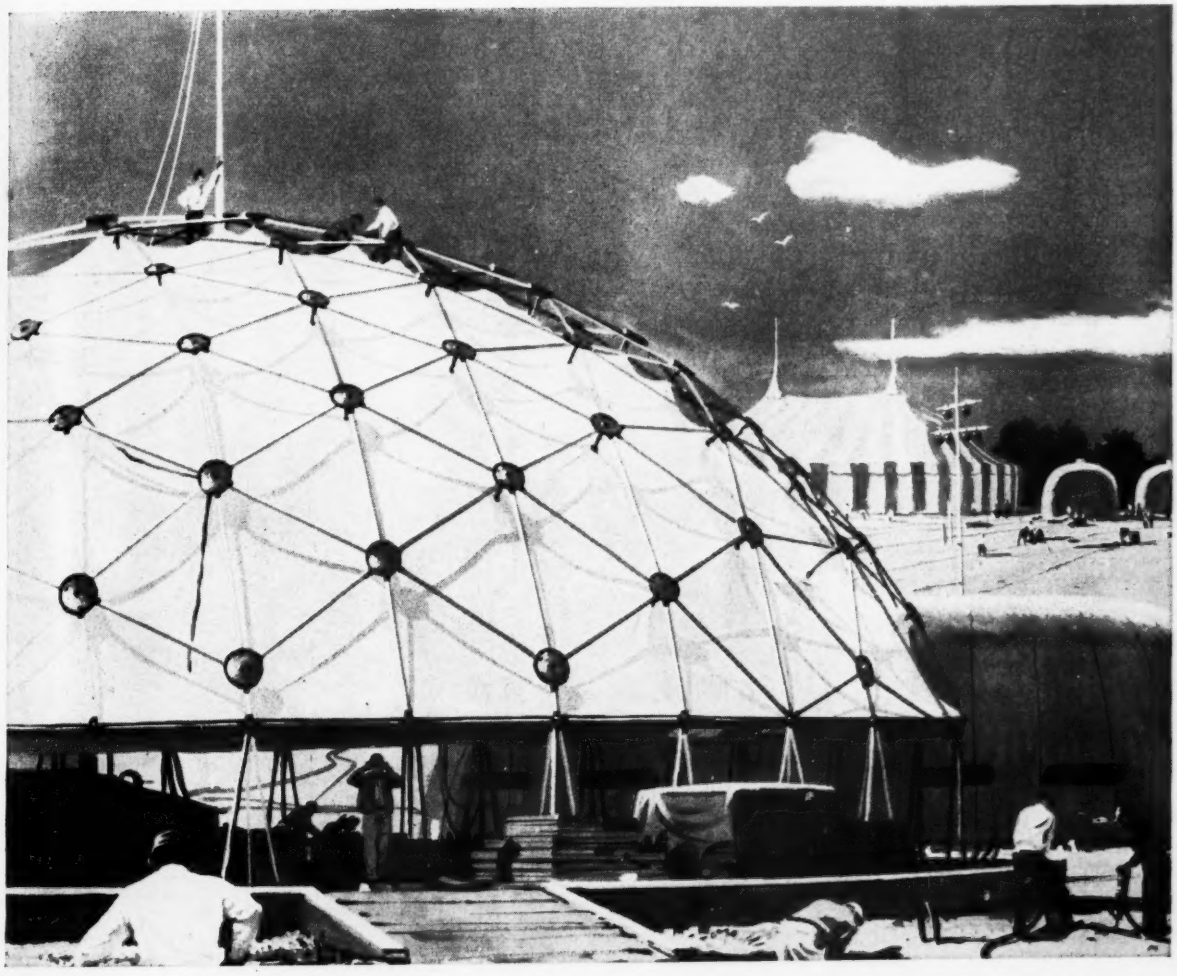
Filament yarn shipments to domestic consumers for December totaled 60,500,000 pounds, of which 27,700,000 pounds were high-tenacity rayon yarn and 32,800,000 pounds were regular-tenacity rayon yarn. Shipments for 1958 were: total 642,800,000 pounds; high-tenacity, 266,200,000 pounds; regular-tenacity, 376,600,000 pounds. Shipments for 1957 had been: total, 684,700,000 pounds; high-tenacity, 324,000,000 pounds; regular-tenacity, 360,700,000 pounds.

Stocks on December 31 totaled 51,700,000 pounds, made up of 8,600,000 pounds of high-tenacity rayon yarn and 43,100,000 pounds of regular-tenacity rayon yarn. End-of-1957 stocks had been: total, 71,800,000 pounds; high-

(Continued on page 934)

• *"Geodesic"* structure is made of vinyl coated "Welkote," Wellington Sears nylon fabric engineered for vinyl and neoprene coating. Fabric is suspended from its rigid framework — no interior posts or supports.*

*Pat'd by R. Buckminster Fuller



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Los Angeles • Philadelphia • San Francisco • St. Louis

WEST POINT TEXTILES

Synthetic Rubbers and Latices*

Monomers

11-80, 100, 200, 112-3 Triols	lb.	$0.255
11-300	lb.	.265
11-400	lb.	.325
Acrylonitrile	lb.	.27
Butadiene	lb.	.15
Dow Styrene	lb.	.12
H99, N99	lb.	.205
RG	lb.	.17
Vinyltoluene	lb.	.17
EGD	lb.	1.75 / $2.00
Hylene M	lb.	1.26 / 1.28
M-50	lb.	.87 / .89
T	lb.	1.02 / 1.04
TM	lb.	.87 / .89
-65	lb.	.92 / .94
Isobutylene	gal.	.38
Isoprene	lb.	.25
Mondur-C	lb.	1.05
Monomer MG-1	lb.	1.00 / 1.25
-S	lb.	.85
MPL	lb.	1.75 / 2.00
Multron R-2	lb.	.54
P200	lb.	.23
Rohm & Haas ethyl acrylate	lb.	.34 / .36
Glacial methacrylic acid	lb.	.45 / .47
Methyl acrylate	lb.	.37 / .39
Methacrylate	lb.	.29 / .31

Shortstops

DDM	lb.	.88 / .915
Mercaptan 174	lb.	.38 / .50
Sharstop	lb.	.33 / .37
268	lb.	.52 / .53
Tecquinol	lb.	.825 / .845
Thiostop K	lb.	.50 / .53
N	lb.	.38 / .47
Vulnapol KM	lb.	.52 / .56
NM	lb.	.38 / .42
Wingstop B	lb.	.38

Acrylic Types

Acrylon BA-15	lb.	1.25[a]
EA-5	lb.	1.00[a]
Hycar 4021	1.34[c] /	1.35[c]

Latices

Hycar 2600X30, 2600X39, 2601	lb. .50 /	.56

Fluorocarbon Types

Kel-F Elastomer	lb.	15.00 / 16.00
5500, 820 (Latex)	lb.	15.00 / 17.15
Viton A, AHV	lb.	15.00

Isobutylene Types

Enjay Butyl 035, 065, 150 215, 217, 218		.23[a]
165, 268, 325, 365		.24[a]
Hycar 2202	.65[c] /	.75[c]
Polysar Butyl 100, 200, 300 400		.245[c]
101		.2775[a]
301		.255[c]
Vistanex LM		.45[a]
MM		.35[a]

Neoprene Types (CR)

Neoprene Type AC, AD, CG	.55[a] /	.575[a]
FB	.65[a] /	.67[a]
GN, GN-A, WX	.41[a] /	.435[a]
GRT, S	.42[a] /	.445[a]
KNR	.75[a] /	.775[a]
W, WHV	.39[a] /	.415[a]
WRT	.45[a] /	.475[a]

Latices

Neoprene Latex 571, 842-A	.37[a] /	.47[a]
572	.39[a] /	.40[a]
60, 601-A	.40[a] /	.50[a]
635	.41[a] /	.51[a]
650	.42[a] /	.52[a]
735, 736	.38[a] /	.48[a]
750	.39[a] /	.49[a]
950	.47[a] /	.57[a]

Nitrile Types

Butaprene NF		.49[b]
NH		.65[b]
NL		.50[b]
NXM		.58[b]
Chemigum, N1NS		.64[b]
N3NS, N5		.58[b]
N6, N-6B, N7, N8		.50[b]
N600		.50[b]
Hycar 1001, 1041	.58[c] /	.59[a]
1002, 1042, 1043, 1052, 1053, 1312	.50[c] /	.51[c]
1014	.60[c] /	.61[c]
1072	.64[c] /	.65[c]
1411	.62[c] /	.63[c]
1432, 1441	.59[c] /	.60[c]
Paracril, AJ		.485[c]
B, BJ, BJLT, BLT		.51[c]
C, CLT		.59[c]
CV		.60[c]
D		.65[c]
18-80		.60[c]
Polysar Krynac 800, 802, 803		.50[c]
801		.58[c]

Latices

Butaprene N-300		$0.46[b]
N-400, N-401		.54[b]
Chemigum 200		.49[b]
235 CHS, 236		.54[b]
245 B, 245 CHS, 246, 247, 248		.46[b]
Hycar 1512, 1552, 1562, 1577	$0.46[c] /	.52[c]
1551, 1561, 1571	.54[c] /	.60[c]
1852	.46[c] /	.52[c]
Nitrex 2612, 2614	.46[a] /	.52[a]
2615	.51[a] /	.57[a]
2616	.54[a] /	.60[a]
2617	.46[a] /	.52[a]
2619	.53[a] /	.59[a]
2620, 2625	.46[a] /	.52[a]

Polyethylene Type

Hypalon 20, 30	lb. .70 /	.725

Polysulfide Types

Thiokol LP-2, -3, -31, -32, -33		.96[a]
-8		1.35[a]
-205		4.00[a]
Type-A		.50[a]
FA		.69[a]
ST		1.25[a]

Latices

Thiokol Latex (dry wt.) Type MX		.80[a]
WD-2		1.25[a]
-6	.80[a] /	1.25[a]

Silicone Types

GE (compounded)	2.29[c] /	4.90[c]
Silicone gum (not compounded)	3.85[c] /	4.55[c]
Silastic (compounded)	2.95[b] /	3.50[b]
(Partly compounded)	3.15[b] /	3.60[b]
(Uncompounded)	4.05[b] /	4.35[b]
LS-53	18.00 /	24.00[b]
Union Carbide (compounds)	2.35[b] /	3.20[b]
(Gums)	3.85[b] /	4.25[b]

Styrene Types

Hot SBR†

Ameripol 1000, 1001, 1006, 1007	.24[c] /	.247[c]
1002	.2435[c]/	.2495[c]
1006 Crumb	.2475[c]/	.2535[c]
1009	.2475[c]/	.2535[c]
Crumb	.259[c] /	.265[c]
1011	.2475[c]/	.2535[c]
1012	.2425[c]/	.2485[c]
Crumb	.249[c] /	.255[c]
1013	.25[c] /	.2560[c]
Crumb	.2615[c]/	.2675[c]
ASRC 1004, 1006, 1009	.241[c] /	.2475[c]
1018		.270[c]
1019		.265[c]
Copo 1006	.241[c] /	.247[c]
FR-S 1000, 1001, 1004, 1006	.241[c] /	.247[c]
1009	.2475[c]/	.2535[c]
1010	.26[c] /	.266[c]
1012	.2425[c]/	.2485[c]
1013	.25[c] /	.256[c]
Crumb	.2615[c]/	.2675[c]
1014	.281[c] /	.287[c]
Naugapol 1016, 1019		.265[b]
1018		.27[b]
1021		.30[b]
1022		.28[b]
1023		.285[b]
Philprene 1000, 1001, 1006		.241[b]
1009		.2475[b]
1010		.26[b]
1018		.27[b]
1019		.265[b]
Plioflex 1006	.241[c] /	.247[c]
Polysar S, S-50		.241[c]
S-X-371		.255[c]
S-1000, -1006, -1013		.23[a]
-1002, -1011		.2325[a]
-1009		.24[a]
Synpol 1000, 1001, 1006, 1007, 1061	.241[b] /	.247[b]
1002	.2435[b]/	.2495[b]
1012	.2425[b]/	.2485[b]
1009	.2475[b]/	.2535[b]
8000	.241[b] /	.247[b]

Hot SBR Black Masterbatch

Philprene 1100		.194
1104		.190[b]
S-1100		.185[a]

Cold SBR

Ameripol 1500, 1501, 1502	.241[c] /	.247[c]
ASRC 1500, 1502		.241[c]
1503		.2625[c]
Copo 1500, 1502	.241[c] /	.247[c]
1505	.261[c] /	.267[c]
FR-S 1500, 1502	.241[c] /	.247[c]
Naugapol 1503		.2625[b]
1504		.295[b]
6000		.31[b]
Philprene 1500, 1502		.241[b]
1503		.2625[b]
Plioflex 1500, 1502		.241[c]
Polysar Kryflex 200		.251[c]
SS-250, SS-250-Flake		.2875[c]
Krylene, NS		.241[a]
S-1500, S-1502-S		$0.23[a]
S-1506		.25[a]
Synpol 1500, 1502, 1551	$0.241[b] /	.247[b]

Cold SBR Black Masterbatch

Ameripol 4600	.241[c] /	.247[c]
4650	.182[c] /	.188[c]
4651	.177[c] /	.183[c]
4652	.1425[c]/	.1485[c]
4654	.187[c] /	.193[c]
4655	.182[c] /	.188[c]
Baytown 1600, 1601, 1602		.193[b]
Philprene 1600, 1601		.193[b]
1605		.19[b]
S-1600, -1602		.1825[a]
-1605		.18[a]
Synpol 8150	.193[b] /	.199[b]

Cold SBR Oil Masterbatch

Ameripol 1703	.206[c] /	.212[c]
1705	.2035[c]/	.2095[c]
1707, 1708	.191[c] /	.197[c]
1710, 1712	.1885[c]/	.1945[c]
4700	.175[c] /	.181[c]
4701	.1725[c]/	.1785[c]
ASRC 1703		.206[c]
1708		.191[c]
Carbomix 3750	.182[c] /	.188[c]
3752	.1845[c]/	.1905[c]
3754	.177[c] /	.183[c]
Copo 1712	.1885[c]/	.1945[c]
1773	.206[c] /	.212[c]
1778	.191[c] /	.197[c]
FR-S 1703	.206[c] /	.212[c]
1712	.1885[c]/	.1945[c]
Philprene 1703		.206[b]
1706		.203[b]
1708		.191[b]
1710, 1712		.1885[b]
Plioflex 1703, 1773	.206[c] /	.212[c]
1710, 1712		.1885[c]
1713	.175[c] /	.181[c]
1714C	.1725[c]/	.1785[c]
1778	.191[c] /	.197[c]
Polysar Krynol 651		.1885[c]
652		.191[c]
S-1703		.195[a]
-1706		.1925[b]
-1707		.18[a]
-1709, -1712		.1775[a]
Synpol 1703	.206[b] /	.212[b]
1707, 1708	.191[b] /	.197[b]
1711	.19[b] /	.196[b]
1712	.1885[b]/	.1945[b]
8200	.191[b] /	.197[b]
8201	.175[b] /	.181[b]

Hot SBR Latices

FR-S 2000, 2001	.2725[c]/	.3425[c]
2002, 2003, 2004	.35[c] /	.36[c]
2006	.29[c] /	.382[c]
Naugatex 2000, 2001	.2775[a]/	.3575[a]
2002	.30[a] /	.37[a]
2006	.29[a] /	.42[a]
Pliolite Latex 2000, 2001		.2825[c]
2076		.295[c]
Polysar Latex II		.29[c]
IV		.2775
S-2000		.2275[a]
2006		.215[a]

Cold SBR Oil-Black Masterbatch

Ameripol 4750	.1545[c]/	.1605[c]
4751	.140[c] /	.146[c]
4752	.160[c] /	.166[c]
4753	.148[c] /	.154[c]
Baytown 1801		.176[b]
Carbomix 3751, 3758	.1545[c]/	.1605[c]
3753, 3759	.164[c] /	.170[c]
3755	.147[c] /	.153[c]
3756	.1576[c]/	.1636[c]
3757	.148[c] /	.154[c]
Philprene 1803		.174[b]
S-1803		.165[a]
-1804		.175[a]
Synpol 8250	.174[b] /	.18[b]
8253	.1584[b]/	.1644[b]
8254	.1545[b]/	.1605[b]

Cold SBR Rosin Masterbatch

Copo 3900	.231[c] /	.237[c]

Cold SBR Latex

Copo 2101, 2108	.30[c] /	.4025[c]
2102, 2105, 2110, 3851	.32[c] /	.3725[c]
2109	.2775[c]/	.3450[c]
3852	.2900[c]/	.3500[c]
FR-S 2105		.366[c]
Naugatex 2105, 2107	.32[a] /	.38[a]
2108	.30[a] /	.38[a]
2113	.29[a] /	.36[a]
Polysar Latex 721		.32[c]
Pliolite Latex 2101		.30[c]
2105, 2107		.32[c]
2108		.30[c]
S-2101		.225
-2105		.31[a]
-2107		.32[a]

Cold BR Latex‡

Pliolite Latex 2104		.325[a]

[a] Freight extra.
[b] Minimum freight allowed.
[c] Freight prepaid.
* Prices are per pound carload or tank-car dry weight unless otherwise specified.
† SBR—Styrene-butadiene rubber.
‡ BR—Butadiene rubber.

Compounding Ingredients*

Abrasives

Pumicestone, powdered	lb.	$0.0363/	$0.065
Rottenstone, domestic	lb.	.03 /	.04
Shelblast	ton	80.00 /	165.00
Walnut Shell Grits	ton	50.00 /	160.00

Accelerators

A-1 (Thiocarbanilide)	ton	.50 /	.57
A-32	ton	.66 /	.80
A-100	lb.	.52 /	.66
Accelerator 49		.59 /	.60
52	lb.	1.14	
57, 62, 67, 77	lb.	1.04	
66	lb.	4.25	
89	lb.	1.20	
108	lb.	.92 /	.97
552	lb.	2.25	
808	lb.	.66 /	.68
833	lb.	1.17 /	1.19
Altax	lb.	.54 /	.56
Arazate	lb.	2.25 /	2.30
Beutene	lb.	.66 /	.71
Bismate	lb.	3.00	
B-J-F	lb.	.27 /	.32
Butasan	lb.	1.04	
Butazate	lb.	1.04 /	1.09
Butyl Accelerator Eight	lb.	1.35	
Namate	lb.	.45 /	.50
Zimate	lb.	1.04	
Ziram	lb.	.89 /	1.04
Captax	lb.	.44 /	.46
Conac S	lb.	.76 /	.78
C-P-B	lb.	1.95 /	2.00
Cumate	lb.	1.45	
Cydac	lb.	.76 /	.78
Dibs	lb.	.85	
Dipac	lb.	.85	
DOTG (diorthotolylguanidine)			
Cyanamid	lb.	.69 /	.70
Du Pont	lb.	.69 /	.70
DPG (diphenylguanidine)			
Cyanamid	lb.	.49 /	.50
Monsanto	lb.	.52 /	.58
El-Sixty	lb.	.62 /	.64
Ethasan	lb.	1.04	
Ethazate	lb.	1.04 /	1.09
50-D	lb.	.87 /	.92
Ethyl Seleram	lb.	3.00	
Thiurad	lb.	1.04	
Thiram	lb.	1.04	
Tuads	lb.	1.04	
Tuex	lb.	1.04 /	1.09
Zimate	lb.	1.04	
Ziram	lb.	.89 /	1.04
Ethylac #650	lb.	.93 /	.95
Guantal	lb.	.60 /	.67
Hepteen	lb.	.44 /	.50
Base	lb.	1.85 /	1.90
Ledate	lb.	1.04	
MBT (2-mercaptobenzothiazole)			
American Cyanamid	lb.	.44 /	.46
Du Pont	lb.	.44 /	.46
Naugatuck	lb.	.44 /	.49
-XXX, Cyanamid	lb.	.55 /	.57
MBTS (mercaptobenzothiazyl disulfide)			
Cyanamid	lb.	.54 /	.56
Du Pont	lb.	.54 /	.56
Naugatuck	lb.	.54 /	.59
-W Cyanamid	lb.	.59 /	.61
Merac #225	lb.	.75 /	1.05
Mertax	lb.	.55 /	.57
Methasan	lb.	1.04	
Methazate	lb.	1.04 /	1.09
Methyl Thiram	lb.	1.14	
Tuads	lb.	1.14	
Zimate	lb.	1.04	
Monex	lb.	1.14 /	1.19
Mono-Thiurad	lb.	1.14	
2-MT (2-mercaptothiazoline)			
Cynamid	lb.	.88 /	.90
Du Pont	lb.	1.00	
NA-22	lb.	1.05	
NOBS No. 1	lb.	.76 /	.78
Special	lb.	.80 /	.82
O-X-A-F	lb.	.55 /	.60
Pennac SDB	lb.	.45 /	.48
Pentex	lb.	1.24 /	1.29
Flour	lb.	.30 /	.35
Permalux	lb.	2.25	
Phenex	lb.	.52 /	.59
Pip-Pip		2.07	
Polyac Pellets	lb.	1.85	
R-2 Crystals	lb.	4.35	
Rotax	lb.	.55 /	.57
RZ-50, -50B	lb.	1.00	
S. A. 52	lb.	1.14	
57, 62, 67, 77	lb.	1.04	
66	lb.	3.00	
Santocure	lb.	.76 /	.78
NS	lb.	.80 /	.82
Selenacs	lb.	3.00	
SPDX-GH	lb.	.69 /	.74
GL	lb.	1.20 /	1.34
Sulfads	lb.	1.98	
Tellurac	lb.	1.30 /	1.55
Tepidone	lb.	.45 /	.45
Tetrone A	lb.	1.98	
Thiates	lb.	.88 /	1.25
Thiofide	lb.	.54 /	.56
S	lb.	.64 /	.66
Thionex	lb.	1.14	
Thiotax	lb.	.44 /	.46
Thiurad	lb.	1.14	
Thiuram E	lb.	$1.04	
M	lb.	1.14	
Trimene	lb.	.56 /	$0.62
Base	lb.	1.03 /	1.10
Tuex	lb.	1.14	
Ultex	lb.	1.00 /	1.10
Unads	lb.	1.14	
Ureka Base	lb.	.66 /	.73
Vulcacure NB	lb.	.45	
NS	lb.	.75 /	1.05
T.M.D.	lb.	1.14	
ZB, ZE, ZM	lb.	.85 /	.89
Z-B-X	lb.	2.45 /	2.50
Zenite	lb.	.54 /	.56
A	lb.	.69 /	.71
AM	lb.	.76 /	.78
Special	lb.	.55 /	.57
Zetax	lb.	.51 /	.53
Zimate	lb.	1.04	

Accelerator-Activators, Inorganic

Lime, hydrated	ton	21.96	
Litharge, comml.	lb.	.1375/	.1575
Eagle, sublimed	lb.	.1385	
National Lead, sublimed	lb.	.1485	
Red lead, comml.	lb.	.185 /	.195
Eagle	lb.	.1425	
National Lead	lb.	.1525/	.1545
PRD-90	lb.	.38 /	.50
White lead, carbonate	lb.	.19 /	.20
Eagle	lb.	.1775/	.1875
National Lead	lb.	.175 /	.185
Silicate	lb.	.1725/	.1825
Eagle	lb.	.1425/	.1725
National Lead	lb.	.1625/	.1725
Zinc oxide, comml.†	lb.	.145 /	.1925

Accelerator-Activators, Organic

Aktone	lb.	.2125/	.2325
Barak	lb.	.65	
Capital 170	lb.	.20 /	.25
171	lb.	.1425/	.1925
255, 258, 710	lb.	.14 /	.19
270	lb.	.1175/	.1425
261	lb.	.155 /	.18
262	lb.	.16 /	.185
263	lb.	.1775/	.2025
Curade	lb.	.57 /	.59
D-B-A	lb.	1.95	
Emery 600	lb.	.1425/	.1925
G-M-F	lb.	2.60 /	2.65
PDD-70	lb.	2.70 /	3.00
PGD-25	lb.	1.25 /	1.50
Groco 30	lb.	.1425/	.1925
35	lb.	.1475/	.1975
Guantal	lb.	.62 /	.64
Hyfac 410	lb.	.1525/	.1775
430	lb.	.18 /	.205
431	lb.	.2025/	.2275
Hystrene S-97	lb.	.1863/	.2125
T 45	lb.	.1638/	.19
T-70	lb.	.1738/	.20
Industrene B	lb.	.1263/	.1525
R	lb.	.1138/	.14
158	lb.	.1313/	.1575
254	lb.	.1413/	.1675
262	lb.	.1513/	.1775
Laurex	lb.	.34 /	.38
MODX	lb.	.295 /	.345
NA-22	lb.	1.05	
PND-70	lb.	1.35 /	1.60
Oleic acid, comml.	lb.	.185 /	.225
Emersol 210 Elaine	lb.	.1475/	.1975
Groco 2, 4, 8, 18	lb.	.14 /	.195
Welcoline	lb.	.21 /	.42
Plastone	lb.	.27 /	.30
Polyac	lb.	1.85	
Ridacto	lb.	.25 /	.26
Seedine	lb.	.1485/	.1703
Stearex Beads	lb.	.1488/	.1588
Stearic acid			
Emersol 120	lb.	.1675/	.1875
150	lb.	.1925/	.2175
Hydrofoil 51	lb.	.09	
Hydrogenated, rubber grd.			
Groco 56	lb.	.1225/	.1475
Rufat 75	lb.	.1062/	.1325
Single pressed, comml.	lb.	.1475/	.1675
Emersol 110	lb.	.1625/	.1875
Groco 54	lb.	.16 /	.185
Wilmar 253	lb.	.1525/	.1775
Double pressed, comml.	lb.	.1525/	.1725
Groco 54	lb.	.165 /	.19
Wilmar 254	lb.	.1575/	.1825
Triple pressed, comml.	lb.	.175 /	.195
Groco 55	lb.	.1775/	.2025
Wilmar 255	lb.	.1875/	.2075
Sterene 60-R	lb.	.09 /	.1075
Tonox	lb.	.515 /	.605
Vimbra	lb.	.32 /	.385
Vulklor	lb.	.88 /	1.08
Wilmar 110	lb.	.17 /	.22
434	lb.	.1425/	.1925
Zinc stearate, comml.	lb.	.39 /	.44

Antioxidants

AC-1	lb.	.37 /	.86
-S	lb.	1.49 /	1.63
AgeRite Alba	lb.	$2.40 /	$2.50
Gel	lb.	.70 /	.72
H. P.	lb.	.79 /	.81
Hipar	lb.	1.05 /	1.07
Powder	lb.	.57 /	.59
Age Resin	lb.	.88 /	.90
D	lb.	.57 /	.59
Spar	lb.	.57 /	.59
Stalite	lb.	.57 /	.59
S	lb.	.57 /	.59
Superlite	lb.	.57 /	.59
White	lb.	1.50 /	1.60
Akroflex C	lb.	.85 /	.87
CD	lb.	.79 /	.81
Albasan	lb.	.69 /	.73
Alcogard 354 Powder	lb.	1.50 /	1.52
Allied AA 1144	lb.	.23 /	.24
AA-1177	lb.	.155 /	.165
Aminox	lb.	.57 /	.62
Antioxidant 425	lb.	2.47 /	2.50
2246	lb.	1.50 /	1.53
Antisol	lb.	.23 /	.24
Antisun	lb.	.15 /	.51
Antox	lb.	.59 /	.61
Aranox	lb.	3.25 /	3.30
Betanox Special	lb.	.91 /	.96
B-L-E, -25	lb.	.57 /	.62
Burgess Antisun Wax	lb.	.185	
B-X-A	lb.	.55 /	.60
Catalin AC-5	lb.	1.49 /	1.63
Copper Inhibiter X-872-L	lb.	2.01	
D-B-P-C	lb.	.91 /	1.16
Deenax	lb.	.95	
Flectol H	lb.	.57 /	.59
Flexamine	lb.	.79 /	.84
Heliozone	lb.	.31 /	.32
Ionol	lb.	.91 /	1.65
Microflake	lb.	.20 /	.24
Naugawhite	lb.	.57 /	.62
NBC	lb.	1.67	
Neozone A	lb.	.64 /	.66
C	lb.	.86 /	.88
D, Special	lb.	.57 /	.59
Nevastain A	lb.	.51 /	.61
B	lb.	.51 /	.70
Octamine	lb.	.57 /	.62
PDA-10	lb.	.46 /	.48
Perflectol	lb.	.61 /	.68
Permalux	lb.	2.25	
Polygard	lb.	.57 /	.62
Polylite	lb.	.55 /	.60
Protector	lb.	.26 /	.31
Rio Resin	lb.	.60 /	.62
Santoflex 35	lb.	.72 /	.79
75	lb.	1.01 /	1.03
AW	lb.	.71 /	.78
B	lb.	.52 /	.59
BX	lb.	.63 /	.70
DD	lb.	.57 /	.59
Santovar A	lb.	1.55 /	1.57
Santowhite Crystals, Powder	lb.	1.55 /	1.62
L	lb.	.57 /	.59
MK	lb.	1.25 /	1.32
Stabilite	lb.	.55 /	.59
Alba	lb.	.72 /	.79
L	lb.	.60 /	.64
White	lb.	.52 /	.60
Powder	lb.	.41 /	.47
Styphen I	lb.	.51 /	.55
Sunolite #100	lb.	.21 /	.23
#127	lb.	.17 /	.19
Sunproof-713	lb.	.26 /	.31
Improved	lb.	.25 /	.30
Jr.	lb.	.22 /	.27
Tenamene 3	lb.	.91 /	1.05
Thermoflex	lb.	1.05 /	1.07
Tonox	lb.	.54 /	.59
Tysonite	lb.	.24 /	.2475
Velvapex 51-250	lb.	.40 /	
V-G-B	lb.	.75 /	.80
Wing-Stay S, T	lb.	.55 /	.67
100	lb.	1.00 /	1.08
Zalba	lb.	1.10	
Zenite	lb.	.52 /	.54

Antiozonants

Eastozone 30, 31	lb.	1.05 /	1.09
Flexone 6-H	lb.	1.25	
Tenamene 30, 31	lb.	1.24 /	1.28
UOP 88, 288	lb.	1.05 /	1.07

Antiseptics

Copper naphthenate, 6-8%	lb.	.245	
Pentachlorophenol	lb.	.22 /	.30
Resorcinol, technical	lb.	.775 /	.785
Zinc naphthenate, 8-10%	lb.	.245 /	.30

Blowing Agents

Ammonium bicarbonate	lb.	.07 /	.09
Carbonate	lb.	.16	
Blowing Agent CP 1475	lb.	.32 /	.35
Celogen	lb.	1.95 /	2.00
50 C	lb.	1.01 /	1.07
Kempore R-125	lb.	1.92	
Opex 40	lb.	.72 /	.72
Sodium bicarbonate	100 lbs.	2.55 /	3.85
Carbonate, tech.	100 lbs.	1.35 /	5.52
Sponge Paste	lb.	.20	
Unicel ND	lb.	.72	
NDX	lb.	1.44	
S	lb.	.20	

Bonding Agents

Braze	gal.	6.00 /	9.00
Cover cement	gal.	2.50 /	4.00
Chemlok 201, 203	gal.	5.00 /	7.50
220	gal.	9.25 /	12.00
401	gal.	11.70 /	14.40

* Prices, in general, are f.o.b. works. Range indicates grade or quantity variations. No guarantee of these prices is made. Spot prices should be obtained from individual suppliers.

† For trade names, see Color—White, Zinc Oxides.

Chemlok 602	gal.	$25.00 /	$26.00
607	gal.	18.00 /	
614	lb.	4.35 /	4.75
Flocking Adhesive RFA17, RFA22, RFA25	lb.	.50	
G-E Silicone Paste SS-15	lb.	4.52 /	5.10
SS-64	lb.	3.65 /	6.75
-67 Primer	lb.	7.50 /	12.50
Gen-Tac Latex	lb.	.70 /	.805
Hylene M	gal.	3.50 /	3.75
M-50	gal.	1.90 /	2.15
Kalabond Adhesive	gal.	6.50 /	16.00
Tie Cement	gal.	2.00 /	5.60
Thixons	gal.	1.48 /	12.00
Ty Ply, BN, Q, S, UP, 3640	gal.	6.75 /	8.00
RC	gal.	3.75 /	5.00

Brake Lining Saturants

BRT 3	lb.	.018 /	.0265
Resinex L-S	lb.	.0225/	.03

Carbon Blacks‡

Conductive Channel—CC

Continental R-40	lb.	.23 /	.30
Kosmos/Dixie BB	lb.	.23 /	.30
Spheron C	lb.	.18 /	.24
Voltex	lb.	.18 /	.315

Easy Processing Channel—EPC

Collocarb EPC	lb.	.059 /	.099
Continental AA	lb.	.074 /	.1225
Kosmobile 77/Dixiedensed 77	lb.	.074 /	.1225
Micronex W-6	lb.	.0725/	.145
Spheron #9	lb.	.0775/	.145
Texas E	lb.	.0775/	.145
Witco #12	lb.	.074 /	.1225
Wyex EPC	lb.	.0775/	.135

Hard Processing Channel—HPC

Continental F	lb.	.074 /	.1225
HX HPC	lb.	.074 /	.1225
Kosmobile S/Dixiedensed S	lb.	.074 /	.1225
Micronex Mk. II	lb.	.0775/	.145
Witco #6	lb.	.074 /	.1225

Medium Processing Channel—MPC

Arrow MPC	lb.	.0775/	.135
Continental A	lb.	.074 /	.1225
Kosmobile S-66/Dixiedensed S-66	lb.	.0775/	.145
Micronex Standard	lb.	.0725/	.145
Spheron #6	lb.	.0775/	.145
Texas 109	lb.	.084 /	.1475
M	lb.	.0775/	.145
Witco #1	lb.	.074 /	.1225

Conductive Furnace—CF

Aromex CF	lb.	.0875/	.145
Vulcan C	lb.	.110 /	.175
SC	lb.	.18 /	.245
XC-72	lb.	.25 /	.33

Fast Extruding Furnace—FEF

Arovel FEF	lb.	.0675/	.125
Continex FEF	lb.	.06 /	.10
Kosmos 50/Dixie 50	lb.	.06 /	.10
Philblack A	lb.	.0625/	.115
Statex M	lb.	.0625/	.125
Sterling SO	lb.	.0675/	.125

Fine Furnace—FF

Statex B	lb.	.0675/	.13
Sterling 99	lb.	.0725/	.13

High Abrasion Furnace—HAF

Aromex HAF	lb.	.0775/	.135
Continex HAF	lb.	.079 /	.125
Kosmos 60/Dixie 60	lb.	.079 /	.1175
Philblack O	lb.	.0725/	.125
Statex R	lb.	.0725/	.135
Vulcan #3	lb.	.0775/	.135

Intermediate Super Abrasion Furnace—ISAF

Aromex ISAF	lb.	.0925/	.15
Kosmos 70/Dixie 70	lb.	.10 /	.145
Philblack I	lb.	.0875/	.14
Statex 125	lb.	.0875/	.15
Vulcan 6	lb.	.0925/	.15

Super Abrasion Furnace—SAF

Philblack E	lb.	.115 /	.1625
Statex 160	lb.	.11 /	.18
Vulcan 9	lb.	.115 /	.18

General-Purpose Furnace—GPF

Arogen GPF	lb.	.06 /	.1175
Statex G	lb.	.055 /	.1175
Sterling V	lb.	.06 /	.1175
V Non-staining	lb.	.06 /	.1175

High Modulus Furnace—HMF

Collocarb HMF	lb.	.045 /	.085
Continex HMF	lb.	$0.055 /	$0.095
Kosmos 40/Dixie 40	lb.	.055 /	.095
Modulex HMF	lb.	.0625/	.12
Statex 93	lb.	.0575/	.12
930	lb.	.047 /	.087
Sterling L, LL	lb.	.0625/	.12

Semi-Reinforcing Furnace—SRF

Collocarb SRF	lb.	.042 /	.082
Continex SRF	lb.	.045 /	.085
Essex SRF	lb.	.0575/	.115
Furnex	lb.	.0525/	.115
Gastex	lb.	.0625/	.125
Kosmos 20/Dixie 20	lb.	.045 /	.085
Pelletex, NS	lb.	.0575/	.115
Sterling NS, S	lb.	.0575/	.115
R	lb.	.0625/	.125

Fine Thermal—FT

P-33	lb.	.0575	
Sterling FT	lb.	.0575	

Medium Thermal—MT

Sterling MT	lb.	.04	
Non-staining	lb.	.05	
Thermax	lb.	.04	
Stainless	lb.	.05	

‡ At the request of the suppliers, the lowest prices shown for carbon blacks are for carloads in bags. Prices for hopper carloads are lower.

Colors

Black

Iron oxides, comml.	lb.	.1235/	.135
BK—Lansco	lb.	.1275/	.13
Williams	lb.	.145	
Lansco synthetic	lb.	.10	
Mapico pure synthetic	lb.	.1475/	.15
Lampblack, comml.	lb.	.16 /	.45
Superjet	lb.	.085 /	.12
Permanent Blue	lb.	.80 /	1.05
Stan-Tone	lb.	.45 /	1.20
Vansul masterbatch	lb.	.60 /	.65
Paste	lb.	.14 /	.15

Blue

Alkali Blue G, R	lb.	2.38	
C. P. Iran Blues	lb.	.52 /	.54
Du Pont	lb.	2.55 /	4.75
Filo	lb.	.28	
Heveatex pastes	lb.	.80 /	1.45
Lansco ultramarines	lb.	.25 /	.28
Monsanto Blue 7	lb.	1.55	
11	lb.	3.45	
DPB-283	lb.	1.93	
S-11	lb.	2.05	
Permanent Blue	lb.	.80 /	1.05
Stan-Tone Violet Blue			
D-4000	lb.	3.45	
4001	lb.	3.00	
4002	lb.	.90	
4900	lb.	1.97 /	2.15
Vansul masterbatch	lb.	.90 /	2.70

Brown

Filo	lb.	.13	
Iron oxides, comml.	lb.	.1425/	.145
Lansco synthetic	lb.	.125	
Mapico Brown	lb.	.1575/	.16
Sienna, burnt, comml.	lb.	.0425/	.155
Williams	lb.	.115 /	.1775
Raw, comml.	lb.	.045 /	.1325
Williams	lb.	.08 /	.1725
Umber, burnt, comml.	lb.	.06 /	.07
Williams	lb.	.0725/	.085
Raw, comml.	lb.	.0625/	.07
Williams	lb.	.07 /	.0825
Williams, pure brown	lb.	.155	
Vandyke	lb.	.12	
Mapico Tan	lb.	.2325/	.235
Metallic brown pure synthetic	lb.	.05 /	.06
Vansul masterbatch	lb.	2.10 /	2.20

Green

Chrome	lb.	.19 /	.50
Green	lb.	.80 /	2.40
Oxide	lb.	.3925/	1.10
Cyanamid	lb.	.42 /	.44
Green G	lb.	3.00	
Lincoln Green	lb.	5.30 /	6.60
G-4099, -6099	lb.	.4525	
GH-9869	lb.	1.10 /	1.25
9976	lb.	1.20 /	1.35
Du Pont	lb.	2.05 /	2.80
Filo	lb.	.40	
Heveatex pastes	lb.	.95 /	1.85
Lansco Toner	lb.	1.35	
Monsanto Green 3	lb.	2.75	
14	lb.	1.45	
17	lb.	3.95	
71205	lb.	1.35	
DGP	lb.	2.03	
S-17	lb.	2.25	
Stan-Tone			
D-5000	lb.	3.95	
5001	lb.	.82	
5400	lb.	1.45	
Vansul masterbatch	lb.	2.00 /	2.60

Orange

Cyanamid Permatons	lb.	1.50 /	1.56
Du Pont	lb.	2.25	
Monsanto Orange 68187	lb.	2.90	
Stan-Tone			
Light orange D-7003	lb.	3.97 /	4.17
70 PCO3	lb.	2.48 /	2.76
Orange 70 PCO4	lb.	2.80 /	3.08
D-7004	lb.	4.23 /	4.43
Stan-Tone Orange D-7104	lb.	$1.85 /	$2.05
Vansul masterbatch	lb.	2.00 /	2.60

Red

Antimony trisulfide	lb.	.285 /	.315
R. M. P. No. 3	lb.	.72	
Sulfur Free	lb.	.78	
Brilliant Toning Red	lb.	1.95	
Cadmium red lithopones	lb.	2.21 /	3.77
Cadmolith	lb.	1.72 /	2.20
Cyanamid	lb.	.93 /	1.90
Naphthol Red, Scarlet	lb.	2.95 /	3.80
Du Pont	lb.	2.00 /	2.05
Filo	lb.	.11	
Indian Red	lb.	.1275	
Iron oxide, comml.	lb.	.06 /	.13
Lansco synthetic	lb.	.1175	
Mapico pure synthetic	lb.	.1425/	.145
Recco	lb.	.12	
Williams Red	lb.	.13 /	1525
Monsanto Maroon 113	lb.	1.50	
61148	lb.	1.75	
Red 7	lb.	1.55	
41	lb.	4.40	
3501	lb.	1.15	
4004	lb.	1.50	
69191	lb.	3.38	
Autumn	lb.	1.10	
PRP-285	lb.	1.27	
S-44	lb.	1.28	
Rub-Er-Red	lb.	.0975	
Stan-Tone			
D-2000	lb.	1.25	
2110, 2120, 2121	lb.	.98	
2200	lb.	1.47	
2500	lb.	1.90	
2600	lb.	4.60	
2601	lb.	1.60	
2700	lb.	1.75	
2800	lb.	1.90	
Light Red D-7005	lb.	4.68 /	4.88
D-7105	lb.	1.97 /	2.17
70 PCO5	lb.	3.00 /	3.28
Red D-7006	lb.	4.89 /	5.09
D-7106	lb.	2.20 /	2.40
70 PCO6	lb.	3.35 /	3.63
Vansul masterbatch	lb.	.95 /	3.30
Venetian	lb.	.04 /	.0675

White

Antimony oxide	lb.	.27 /	.285
Burgess Iceberg	ton	50.00 /	80.00
Cryptone BT	lb.	.10 /	.11
Permolith lithopone	lb.	.08 /	.087
Titanium pigments			
Horse Head Anatase	lb.	.255 /	.27
Rutile	lb.	.275 /	.29
Rayox LW	lb.	.195 /	.205
R-110	lb.	.215 /	.225
Ti-Cal	lb.	.075 /	.0825
Ti-Pure	lb.	.195 /	.225
Titanox A, AA, A-168	lb.	.255 /	.265
C-50	lb.	.1438/	.1488
RA, -10, -50	lb.	.275 /	.285
RC	lb.	.0963/	.1013
-HT, -HTX	lb.	.0963/	.0988
Unitane	lb.	.255 /	.29
Zopaque Anatase	lb.	.245 /	.27
Rutile	lb.	.205 /	.29
Zinc oxide, comml.	lb.	.145 /	.1825
Azo ZZZ-11, -44, -55	lb.	.145 /	.165
20% leaded	lb.	.1505/	.1705
35% leaded	lb.	.155 /	.175
50% leaded	lb.	.1588/	.1788
Eagle AAA, lead free	lb.	.145 /	.155
5% leaded	lb.	.145 /	.155
35% leaded	lb.	.1513/	.1613
50% leaded	lb.	.1538/	.1638
Florence Green Seal	lb.	.1625/	.1725
Red Seal	lb.	.1575/	.1675
White Seal	lb.	.1675/	.1775
Horsehead XX-4, -78	lb.	.145 /	.155
Kadox-15, -17, -72, -515	lb.	.145 /	.155
-25	lb.	.1675/	.1775
Lehigh, 35% leaded	lb.	.1513/	.1613
50% leaded	lb.	.1538/	.1638
Protox-166, -167	lb.	.145 /	.155
St. Joe, lead free	lb.	.145 /	.175
Zinc sulfide, comml.	lb.	.253 /	.263
Cryptone ZS	lb.	.253 /	.263

Yellow

Cadmium yellow lithopones	lb.	1.12 /	1.15
Cadmolith	lb.	1.12 /	1.20
Cyanamid Hansa Yellow	lb.	2.20	
Du Pont	lb.	2.25	
Filo	lb.	.16	
Iron oxide, comml.	lb.	.0525/	.1175
Lansco synthetic	lb.	.1075	
Mapico pure synthetic	lb.	.12 /	.1275
Williams	lb.	.115 /	.1225
Monsanto Yellow 14	lb.	1.91	
10010	lb.	1.91	
BYP-282	lb.	1.21	
GA	lb.	2.45	
S-10010	lb.	1.17	
Stan-Tone			
D-1100	lb.	2.55	
1101	lb.	.69	
Lemon 70 PCO1	lb.	1.77 /	2.19
D-7001	lb.	2.80 /	3.00
Medium yellow 70 PCO2	lb.	1.79 /	2.21
D-7002	lb.	2.98 /	3.18
Vansul masterbatch	lb.	.95 /	1.95
Williams Ocher	lb.	.0575/	.06

Dusting Agents

Diatomaceous silica	ton	32.00 /	48.00
Extrud-o-Lube, conc.	gal.	1.33 /	1.69

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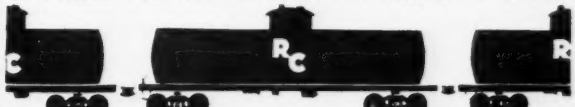

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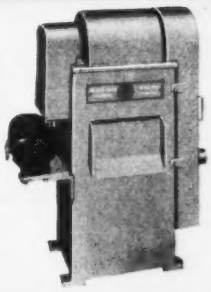

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Latex-Lube GR	lb.	.20	
Pigmented	lb.	.1825	
R-66	lb.	.165	
Liqui-Lube	lb.	.1625	
N. T.	lb.	.1675	
Liquisinc No. 305	lb.	.30 /	.35
Lubrex	lb.	.25 /	.30
Mica, 160 Biotite	lb.	.065 /	.0725
Mesh	lb.	.08 /	.0875
325 Mesh	lb.	.0825/	.09
Concord	lb.	.08 /	.09
Mineralite	ton	45.00	
Pyrax A	ton	14.50 /	15.00
W. A.	ton	17.00 /	17.50
Talc, commL	ton	18.40 /	38.50
EM	ton	11.00 /	63.00
LS Silver	ton	29.25	
Nytals	ton	25.00 /	36.00
Sierra Sagger 7	ton	34.00	
White IR	ton	19.75	
III	ton	20.75	
Vanfre	gal.	2.00	

Extenders

BRS 700	lb.	.02 /	.036
BRT 7	lb.	.035 /	.036
Cumar Resins	lb.	.065 /	.17
Dielex B	lb.	.06	
Factice, Amberex	lb.	.29 /	.36
Brown	lb.	.1425/	.263
Neophax	lb.	.157 /	.268
White	lb.	.144 /	.285
G. B. Asphaltenes	lb.	.097 /	.177
Miller, W	lb.	.07	
Mineral Rubbers			
Black Diamond	ton	38.00 /	40.00
Hard Hydrocarbon	ton	46.50 /	48.50
Hydrocarbon MR	ton	45.00 /	55.00
Parmr	ton	21.00 /	29.00
T-MR Granulated	ton	47.50 /	50.00
Nuba No. 1, 2	lb.	.0575/	.0625
3X	lb.	.0775/	.0825
OPD-101	lb.	.26	
Rubber substitute, brown	lb.	.16 /	.2572
Car-Bel-Ex A	lb.	.14	
Car-Bel-Lite	lb.	.35	
Extender 600	lb.	.1765	
White	lb.	.192 /	.2103
Stan-Shells	ton	35.00 /	73.00
Sublac Resin PX-5	lb.	.215 /	.235
Sundex 53	gal.	.12	
85	gal.	.1725	
Synthetic 100	lb.	.41	
Vistanex	lb.	.35 /	.475

Fillers, Inert

Agrashell flour	ton	50.00 /	74.00
Albacar	ton	55.00 /	75.00
Barytes, floated, white	ton	49.00 /	70.85
Off-color, domestic	ton	25.00	
No. 1	ton	55.00 /	77.50
2	ton	50.00 /	72.50
Sparmite	ton	95.00 /	117.00
Blanc fixe	ton	100.00 /	165.00
Burgess Iceberg	ton	50.00 /	80.30
Pigment #20	ton	35.00 /	60.00
#30	ton	37.00 /	60.00
HC-75	ton	12.00 /	30.00
-80	ton	14.00 /	32.00
WP #1	ton	11.00 /	16.00
Camel-Carb	ton	14.00	
-Tex	ton	22.00	
-Wite	ton	35.00	
Cary #200	ton	30.00 /	55.00
Citrus seed meal	lb.	.04	
Oil	lb.	.15	
Clays			
A. F. D. Filler	ton	29.50 /	36.00
Aiken	ton	14.00	
Albacar	ton	50.00 /	55.00
Aluminum Flake, coarse	ton	25.50 /	28.50
Fine	ton	29.50 /	36.00
#5	ton	27.50 /	34.50
Champion	ton	14.50	
Crown	ton	14.00 /	33.00
Dixie	ton	14.50	
Franklin	ton	13.50 /	35.25
GK Soft Clay	ton	11.00	
Harwick	ton	21.50 /	77.00
Hi-White R	ton	14.50 /	19.50
Hydratex R	ton	28.00	
Kaolloid	ton	10.50	
LGB	ton	17.50	
LGP	ton	20.00	
McNamee	ton	14.50	
RX-43	ton	33.00	
Natka 1200	ton	12.00 /	35.00
Par	ton	13.00	
Paragon	ton	14.50 /	19.50
Polyfil	ton	25.00 /	45.00
Recco	ton	14.00	
Sno-Brite	ton	12.50	
Stan-Clay	ton	28.00	
Stellar-R	ton	50.00	
Suprex	ton	14.50 /	19.50
Swanee	ton	12.50	
Windsor	ton	14.00 /	30.00
DC Silica	lb.	1.15 /	1.40
Diatomaceous silica	ton	32.00 /	48.00
Flocks			
Cotton, dark	lb.	.095 /	.135
Dyed	lb.	.55 /	.60
White	lb.	.13 /	.33
Fabrifil X-24-G	lb.	.135	
X-24-W	lb.	.235	
Filfloc 6000	lb.	.33	
F-40-900	lb.	.135	
HSC #35 Silicone Emulsion	lb.	$ 1.22 /	$02.46
Hydrite	ton	25.00 /	50.00
Kalite	ton	52.50 /	67.50
Lithopone, commL	lb.	.075 /	.085
Astrolith	lb.	.068 /	.0675
Eagle	lb.	.0725/	.075
Permolith	lb.	.08 /	.0875
Sunolith	lb.	.075 /	.0825
Mica, 160 Biotite	lb.	.065 /	.0725
Mesh	lb.	.08 /	.0875
325 Mesh	lb.	.0825/	.09
Concord	lb.	.08 /	.09
Millical	ton	38.00 /	53.00
Mineralite	ton	40.00 /	60.00
Non-Fer-Al	ton	35.00 /	50.00
Ohio Superspray lime	ton	16.50	
Pulverized limestone, Stonelite	ton	8.25 /	11.00
Purecal	ton	56.75 /	71.75
Pyrax A	ton	13.50	
W. A.	ton	16.00	
Sawdust	ton	14.00 /	35.00
Silversheen Mica	lb.	.08 /	.09
StanWhite	ton	10.50 /	13.10
Super-White Silica	ton	25.00 /	46.50
Surfex	ton	37.50 /	52.50
MM	ton	42.00 /	57.00
Suspenso	ton	38.00 /	53.00
Ti-Cal	lb.	.0675	
Valron Estersil	lb.	2.00 /	2.25
Walnut shell flours	ton	50.00 /	84.00
Whiting, limestone			
Atomite	ton	32.50 /	35.00
Calcite	ton	23.00	
Calwhite	ton	20.00 /	27.00
-T	ton	23.00	
Duramite	ton	20.00	
Gamaco	ton	32.50 /	40.00
Keystone	ton	20.00 /	22.00
Laminar	ton	30.00	
No. 10 White	ton	11.00 /	16.50
Omya	ton	30.00	
BSH	ton	45.00	
Paxinosa	ton	14.50 /	22.50
Snowflake	ton	17.00 /	18.00
Witco	ton	13.00	
York	ton	9.50	

Finishes

Apex Bright Finish #5200-E	lb.	.25	
Rubber Finish	gal.	2.50	
Black-out	gal.	4.50 /	8.00
Flocks, Rayon, colored	lb.	.90 /	1.50
White	lb.	.75 /	1.25
Also see Flocks, under Fillers, Inert			
Paraflint RG and RGU Synthetic Wax	lb.	.15 /	.22
Rubber lacquer, clear	gal.	1.00 /	2.00
Shellacs, Angelo	lb.	.485 /	.7325
Vac Dry	lb.	.485 /	.57
Talc (*See Talc, under Dusting Agents*)			
Unidip	lb.	.15 /	.20
Wax, Bees	lb.	.68 /	.83
Carnauba	lb.	.57 /	1.13
Monten	lb.	.27	
No. 118, colors	gal.	.86 /	1.41
Neutral	gal.	.76 /	1.31
Van Wax	gal.	1.45 /	1.50

Latex Compounding Ingredients

Acintol D, DLR	lb.	.06 /	.075
FA #1	lb.	.065 /	.08
#2	lb.	.075 /	.09
Accelerator 552	lb.	2.25	
J-117, -302	lb.	1.00 /	1.15
-144	lb.	.15 /	.30
-307	lb.	1.10 /	1.25
-311	lb.	.60 /	.75
Aerosol, dry types	lb.	.65 /	.80
Liquid types	lb.	.40 /	.75
Alcogard 354	lb.	1.40 /	1.42
Alcogum AK-12	lb.	.12 /	.14
AN-6	lb.	.055 /	.06
-10	lb.	.09 /	10
-25	lb.	.31	
PA-15	lb.	.16	
Alrosol	lb.	.41	
Amberex solutions	lb.	.1675/	.18
Antifoam J-114	lb.	3.25 /	3.45
P-242	lb.	.24 /	.35
Antioxidant J-137, -140	lb.	.55 /	.70
-139, -293	lb.	1.45 /	1.60
-182	lb.	2.00 /	2.15
-186	lb.	1.40 /	1.55
2246	lb.	1.50 /	1.53
Anti Webbing Agent J-183	lb.	.75 /	.90
-297	lb.	.27 /	.40
Aquablak B	lb.	.0975/	.1025
G	lb.	.12 /	.125
K	lb.	.12 /	.125
M	lb.	.105 /	.11
Aquarex D	lb.	.81	
G	lb.	.21	
L	lb.	.94	
MDL	lb.	.33	
ME	lb.	.80	
Aquarex NS	lb.	.60	
SMO	lb.	.50	
WAQ	lb.	.22	
Areskap 50	lb.	.30 /	.38
100, dry	lb.	.60 /	.72
Aresket 240	lb.	.30 /	.38
300, dry	lb.	.60 /	.72
Areskiene 375	lb.	.42 /	.57
Ben-A-Gels	lb.	.98 /	1.40
Bentone 18, 18C	lb.	.45	
34	lb.	.60	
Casein	lb.	$0.22	
Cellosize WP-09, -3, -40	lb.	1.00 /	$1.17
-300	lb.	.85	
CW-12		.70	
-37	lb.	5.45 /	6.65
DC Antifoam A Compound	lb.	.68 /	1.20
B	lb.	2.05 /	4.00
Emulsion	lb.	2.05 /	2.85
AF Emulsion	lb.	5.13 /	6.50
Compound 7	lb.	.125	
Defoama W-1701	lb.	.50	
Defoamer 115a	lb.	.215 /	.235
NDW	lb.		
Dispersing Agents			
Blancol	lb.	.1525/	.26
N	lb.	.155 /	.26
Darvan Nos. 1, 2, 3	lb.	.22 /	.30
Daxad 11, 21, 23, 27	lb.	.08 /	.30
Dispersaid H7A	lb.	.58	
1159	lb.	.43	
Emulphor ON-870	lb.	.50 /	.70
Igepal CO-630	lb.	.2875/	.47
Igepon T-73	lb.	.285 /	.495
T-77	lb.	.45 /	.69
Indulins	lb.	.06 /	.08
Kreelons	lb.	.132 /	.155
Laurelton Oil	lb.	.18	
Leonil SA	lb.	.52 /	.65
Lomar PW	lb.	.18	
Marasperse CB	lb.	.1225/	.1425
N	lb.	.095 /	.105
Modicols	lb.	.17 /	.58
Nekal BA-75	lb.	.395 /	.54
BX-76	lb.	.63 /	.75
Nopco 1287	lb.	.155 /	.195
Orzan A	lb.	.0325	
S	lb.	.0425	
Pluronics	lb.	.335 /	.40
Polyfons	lb.	.08 /	.09
Sorapon SF-78	lb.	.28 /	.40
Tergitol NPX	lb.	.275 /	.3074
TMN	lb.	.2875/	.32
7	lb.	.4125/	.44
Trenamine W-30	lb.	.15	
W-40	lb.	.60 /	.75
Triton R-100	lb.	.12 /	.25
X-100, -102, -114	lb.	.255 /	.36
Dispersions			
Agebest 1293-22	lb.	1.90 /	2.00
AgeRite Alba	lb.	3.00	
Powder, Resin D	lb.	.80	
White	lb.	1.80	
Altax	lb.	.75	
Shield Nos. 2, 6	lb.	.08	
3	lb.	.095	
4-35	lb.	.09	
5	lb.	.093	
7-F, 8	lb.	.165	
55	lb.	.18	
Iron Oxide, 60%	lb.	.40	
L.S.W.	lb.	1.50	
No. 305 Liquizinc	lb.	.30 /	.35
P-33	lb.	.35	
Rotax	lb.	.75	
Sulfur	lb.	.12 /	.30
No. 2	lb.	.14 /	.16
Telloy	lb.	3.00	
Tuads, Methyl	lb.	1.14	
Vulcacure NB	lb.	.45	
NS	lb.	.75 /	1.05
T.M.D.	lb.	1.14	
ZB, ZE, ZM	lb.	.85 /	.89
Vulcanizing, C group	lb.	.40 /	1.30
G group	lb.	.45 /	.90
N group	lb.	.40 /	1.00
Zetax	lb.	.75	
Zimates, Butyl	lb.	1.04	
Ethyl, Methyl	lb.	1.04	
Zinc oxide	lb.	.40	
Emulsions			
AgeRite Stalite	lb.	.75	
Borden Arcco A-25, A-26, 716-30	lb.	.18 /	.19
555-40-R	lb.	.185 /	.205
620-32B	lb.	.20 /	.21
716-35	lb.	.17 /	.18
1041-21	lb.	.165 /	.175
Habuco Resin Nos. 502, 515, 523	lb.	.195 /	.20
503	lb.	.22 /	.225
504, 526	lb.	.19 /	.195
517	lb.	.175 /	.18
524	lb.	.155 /	.16
Resin A-2	lb.	.16 /	.25
P-370	lb.	.175 /	.25
X-210	lb.	.12 /	.22
Freeze-Stabilizer 322	lb.	.40	
12116C	lb.	.52	
Hyonic PE 250	lb.	.255 /	.295
Igepon T-43	lb.	.145 /	.35
T-51	lb.	.125 /	.285
-73	lb.	.285 /	.495
Ludox	lb.	.1675/	.195
Marmix	lb.	.41 /	.48
Merac	lb.	.75 /	1.05
Micronex, colloidal	lb.	.06 /	.072
Modical S	lb.	.3084/	.3284
VD	lb.	.1384/	.1584
Monsanto Blue 4685 WD	lb.	1.60	
Green 4884 WD	lb.	1.80	
Red 127	lb.	1.25	
OPD 101	lb.	.16 /	.26
Picco Latex Plasticizer A-12	lb.	.069 /	.096
Pliolite Latex 150, 190	lb.	.32 /	.41
170	lb.	.37 /	.46
Polyvinyl methyl ether	lb.	.25 /	.45
Resin V	lb.	.13	
Roelgel 100C	lb.	.46	
Santomerse D	lb.	.44 /	.65
S	lb.	.13 /	.25

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WANTED: PROCESS ENGINEER FOR INSULATED WIRE plant located in New Jersey. Engineering Degree preferred, but not essential. Age—over 25. Must have factory experience in rubber mixing and in extrusion techniques on both C. V. and Conventional Tubers. Please write giving experience and salary requirements. Address Box No. 2303, care of RUBBER WORLD.

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Preferable with 2-5 years experience in rubber chemistry or coatings technology for laboratory development and production process development work in the field of pressure-sensitive tapes and elastomeric adhesives. Excellent opportunity to grow with an expanding organization. Reply in confidence to:

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RUBBER CHEMIST—TO WORK IN THE EVALUATION AND application of rubber latices and rug backsizing compounds, as well as the improvement of existing rug backsizing operations. Requirements: Graduate chemist or Textile School major. Experience in the above or allied work. Salary open. Willing to locate in the South. All replies will be kept confidential. Address Box No. 2306, care of RUBBER WORLD.

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PLANT MANAGER, 20 YEARS' DIVERSIFIED EXPERIENCE IN molded, extruded, and dipped goods. Chemically blown, and all types of solid products. Good technical background. Know all types of machinery, processes, quality control, and cost reduction. Have fine record in all phases of management, including personnel, labor relations, and sales organization. Must relocate for family health reasons. Far West, or Southwest preferred, but South or East acceptable. Address Box No. 2300, care of RUBBER WORLD.

CHEMICAL & ENGINEERING TECHNOLOGIST — MANY years' experience in rubber, plastics & latex technology. Extensive pressure-sensitive development and manufacturing experience. Solved many problems in coating, calendering & molding processes. Have been in consulting work, development and production in other chemical & technical fields. Numerous patents registered. B.S. Chem. with PhD. experience level. Mature age; presently employed. Consider new permanent connection or consulting engagements. New Jersey area preferred. Address Box No. 2308, care of RUBBER WORLD.

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Sellogen Gel	lb.	$0.1275	
Sequestrene AA	lb.	.905 /	$0.975
30A	lb.	.245 /	.265
Sequestrene ST	lb.	.585 /	.615
Setsit #5	lb.	.75 /	1.05
D #9	lb.	.85 /	1.15
Stablex A	lb.	.80 /	1.10
B, G	lb.	.50 /	.95
K	lb.	.27 /	.35
P	lb.	.35 /	.50
T	lb.	.14 /	.22
Surfactol 13	lb.	.345 /	.36
Vult-Accel E	lb.	.85 /	.92
Webnix	lb.	1.50 /	2.50

Mold Lubricants

Acintol D	lb.	.06 /	.75
A-C Polyethylene	lb.	.30 /	.47
Alipal CO-433	lb.	.25 /	.45
CO-436	lb.	.22 /	.41
Aquarex Compounds	lb.	.21 /	.94
Carbowax 200, 300, 400	lb.	.22 /	.25
1500	lb.	.255 /	.2625
4000	lb.	.31 /	.32
6000	lb.	.35 /	.36
Castorwax	lb.	.3375/	.3575
Colite Concentrate	gal.	.90 /	1.15
D-Tak Dip #10	gal.	1.50	
DC Mold Release Fluid	lb.	3.14 /	4.75
Compound 4, 7	lb.	5.13 /	6.50
Emulsion 7	lb.	1.20 /	1.74
8, 35, 35A, 35B, 36	lb.	1.20 /	1.74
200 Fluid	lb.	3.14 /	4.75
EL.A	lb.	.82	
FT Wax 200	lb.	.265 /	.42
300	lb.	.295 /	.45
Glycerized Liquid Lubricant, concentrated	gal.	1.25 /	1.63
Igepals	lb.	.2875	.74
Igepon AP-78	lb.	.44 /	.68
T-43	lb.	.145 /	.35
-51	lb.	.125 /	.285
-73	lb.	.285 /	.495
Lubrex	lb.	.27 /	.32
Lubri-Flo	gal.	10.00 /	12.05
Lustermold	lb.	.41	
L-41 Diethyl Silicone Oil	lb.	3.50	
Mold Paste	lb.	.25	
Monopole Oil	lb.	.16	
Monten Wax	lb.	.57	
MR-22	gal.	9.95 /	14.95
Para Lube	lb.	.046 /	.048
Paraffint RG and RGU Synthetic Wax	lb.	.15 /	.22
Plaskon 8406, 8407	lb.	.30 /	.37
8416, 8417	lb.	.35 /	.42
8429	lb.	.40 /	.47
Pluronics	lb.	.335 /	.44
Poly-Brite PE-200	lb.	.28 /	.42
600	lb.	.42 /	.58
Poly-Cone 125X	lb.	1.20 /	1.40
1000	lb.	.93 /	1.06
Polyglycol E series	lb.	.29 /	.42
RA-1, -2, -3	gal.	2.25 /	3.00
Rubber Glo	gal.	.94 /	.97
SM-33, -55, -61, -62	lb.	1.22 /	1.76
Soap, Hawkeye	lb.	1.35 /	1.45
Purity	lb.	.155 /	.165
Sodium stearate	lb.	.40	
Stoner's 700 series	gal.	1.20 /	1.25
800 series	gal.	1.26 /	1.70
900 series	gal.	1.55 /	2.55
A Series	gal.	1.80 /	4.50
Ucon 50-HB Series	lb.	.25 /	.375
Ulco	lb.	.12 /	.23
Vanfre	gal.	1.95 /	3.00

Odorants

Alamasks	lb.	.75 /	6.50
Coumarin	lb.	2.95 /	3.55
Curodex 19	lb.	4.75 /	5.05
188	lb.	5.75	
198	lb.	5.75	
Ethavan	lb.	6.75 /	7.35
Latex Perfume #7	lb.	4.00	
Neutroleum Gamma	lb.	3.60	
Rodo	lb.	4.00 /	5.50
Rubber Perfume #10	lb.	2.60	
Vanillin, Monsanto	lb.	3.00 /	3.15

Plasticizers and Softeners

Acintol R	lb.	.065 /	.07
Adipol 2EH, 10A, XX	lb.	.40 /	.435
BCA	lb.	.43 /	.455
ODY	lb.	.43 /	.465
Admex 710	lb.	.325	
711	lb.	.345	
744	lb.	.40	
Aro Lene #1980	lb.	.10 /	.12
Baker AA Oil	lb.	.195 /	.24
Crystal O Oil	lb.	.21 /	.255
Processed oils	lb.	.215 /	.235
Bardol, 639	lb.	.0275/	.0375
B	lb.	.055 /	.065
Benzoflex 2-45	lb.	.26 /	.29
9-88	lb.	.27 /	.30
Bondogen	lb.	.555 /	.605
BRC-20	lb.	.022 /	.0245
22	lb.	.026 /	.0285
30	lb.	.0165/	.025
521	lb.	.023	
BRH 2	lb.	.0341/	.0351
BRS 700	lb.	.036	
BRT 7	lb.	.035 /	.036
BRV	lb.	.0625/	.065
Bunarex Liquid	lb.	.0425/	.0555
Resins	lb.	.065 /	.1225
Bunnatol G, S	lb.	$0.40 /	$0.505
Butac	lb.	.125 /	.135
Butyl stearate, comml.	lb.	.255	
B-17	lb.	.21	.33
Binney & Smith	lb.	.23 /	.26
Harchem	lb.	.2525/	.3425
Kessoflex	lb.	.245 /	.275
Ohio-Apex	lb.	.245 /	.255
Butyl stearate—G. P.	lb.	.0125/	.02
R-100	lb.	.045 /	.0525
TT	lb.	.017 /	.02
Califlux G. P.	lb.	.015 /	.0225
R-100	lb.	.0475/	.0575
T-T	lb.	.019 /	.0295
510, 550	lb.	.0275/	.0375
Capryl alcohol, comml.	lb.	.195 /	.235
Columbian Carbon	lb.	.195 /	.30
Harchem	lb.	.195 /	.30
Chlorowax 40	lb.	.1625/	.1825
70	lb.	.185 /	.245
S	lb.	.21 /	.27
Circo light	gal.	.17	
Circosol-2XH	gal.	.185	
Contogums	lb.	.0875/	.111
Cumar Resins	lb.	.065 /	.17
DBM (dibutyl-m-cresol)			
Darex	lb.	.32 /	.3475
DBP (dibutyl phthalate), comml.	lb.	.30 /	.133
Darex	lb.	.30 /	.33
Eastman	lb.	.26 /	.30
Harflex 140	lb.	.30 /	.395
Harwick Std. Chem. Co.	lb.	.325 /	.385
Hatco	lb.	.30 /	.33
Monsanto	lb.	.26 /	.30
Naugatuck	lb.	.30 /	.33
Ohio-Apex	lb.	.30 /	.335
PX-104	lb.	.30 /	.33
Rubber Corp. of America	lb.	.26 /	.44
Sherwin-Williams	lb.	.30 /	.33
DBS (dibutylsebacate) comml.	lb.	.66 /	.69
Eastman	lb.	.68 /	.71
Harflex 40	lb.	.655 /	.745
Hatco	lb.	.66 /	.685
Monoplex	lb.	.66 /	.675
Naugatuck	lb.	.665 /	.69
PX-404	lb.	.665 /	.69
DCP (dicaprylphthalate), comml.	lb.	.295 /	.325
Harflex 180	lb.	.27 /	.36
Hatco	lb.	.295 /	.325
Monoplex	lb.	.30 /	.315
DDA (didecyladipate)			
Good-rite GP-236	lb.	.40 /	.55
Kessoflex	lb.	.40 /	.435
DDP (didecylphthalate)			
Good-rite GP-266	lb.	.295 /	.45
Hatco	lb.	.305 /	.435
Defoamer X-3	lb.	.355	
DIBA (diisobutyladipate)			
Darex	lb.	.4325/	.4625
Eastman	lb.	.40 /	.44
Ohio-Apex	lb.	.41 /	.445
DIDA (diisodecyladipate)			
Monsanto	lb.	.40 /	.435
RC	lb.	.40 /	.54
DIDP (diisodecylphthalate)			
Darex	lb.	.32 /	.35
Harchem	lb.	.29 /	.385
Monsanto	lb.	.26 /	.30
Ohio-Apex	lb.	.29 /	.325
PX-120	lb.	.305 /	.335
RC	lb.	.26 /	.43
Dielex B	lb.	.06	
Diethylene glycol, comml.	lb.	.1525/	.1825
Wyandotte	lb.	.15 /	.165
Dinopol IDO	lb.	.285 /	.32
DIOA (diisooctyladipate)			
Harflex 220	lb.	.40 /	.495
Kessoflex	lb.	.40 /	.435
Naugatuck	lb.	.435 /	.465
PX-208	lb.	.425 /	.455
Rubber Corp. of America	lb.	.40 /	.54
DIOP (diisooctylphthalate), comml.	lb.	.305 /	.335
Darex	lb.	.32 /	.35
Eastman	lb.	.25 /	.29
Harflex 120	lb.	.28 /	.375
Hatco	lb.	.305 /	.335
Monsanto	lb.	.25 /	.29
Naugatuck	lb.	.305 /	.335
Ohio-Apex	lb.	.28 /	.315
PX-108	lb.	.305 /	.335
Rubber Corp. of America	lb.	.25 /	.43
Sherwin-Williams	lb.	.32 /	.34
DIOS (diisooctylsebacate), comml.	lb.	.61 /	.64
Rubber Corp. of America	lb.	.5925/	.70
DIOZ (diisooctylazelate)			
Cabflex	lb.	.48 /	.51
Dipolymer Oil	gal.	.33 /	.38
Dispersing Oil No. 10	lb.	.06 /	.0625
DNODA (di-n-octyl-n-decyl adipate), Monsanto	lb.	.40 /	.435
DOA (dioctyladipate), comml.	lb.	.425 /	.455
Eastman	lb.	.40 /	.43
Good-rite GP-233	lb.	.40 /	.55
Harflex 250	lb.	.40 /	.495
Hatco	lb.	.435 /	.465
Monsanto	lb.	.40 /	.435
Naugatuck	lb.	.435 /	.465
PX-238	lb.	.425 /	.455
Rubber Corp. of America	lb.	.40 /	.54
DOP (dioctylphthalate), comml.	lb.	.305 /	.335
Darex	lb.	.32 /	.35
Eastman	lb.	.28 /	.315
Good-rite GP-261	lb.	$0.285 /	$0.44
Harflex 150	lb.	.28 /	.375
Hatco	lb.	.305 /	.335
DOP (comml.)			
Monsanto	lb.	.25 /	.29
Naugatuck	lb.	.305 /	.335
Ohio-Apex	lb.	.28 /	.315
Polycizer 162	lb.	.28 /	.435
PX-138	lb.	.305 /	.335
Rubber Corp. of America	lb.	.25 /	.43
Sherwin-Williams	lb.	.305 /	.335
DOS (dioctylsebacate), comml.		.61 /	.64
Eastman	lb.	.61 /	.64
Harflex 50	lb.	.5925/	.6825
Hatco	lb.	.61 /	.635
Monoplex	lb.	.61 /	.635
Naugatuck	lb.	.615 /	.64
PX-438	lb.	.615 /	.64
Rubber Corp. of America	lb.	.5925/	.70
DOZ (di-2-ethylhexyl azelate)			
Kessoflex	lb.	.46 /	.48
Drapex 3.2	lb.	.40 /	.54
Dutch Boy NL-A10 (DBP)	lb.	.30 /	.33
-A20 (DOP), A30 (DIOP)	lb.	.305 /	.335
-A54	lb.	.295 /	.325
-C20 (DOS)	lb.	.61 /	.63
-F21	lb.	.395 /	.425
-F31	lb.	.44 /	.47
-F41	lb.	.48 /	.51
Dutrex 6	lb.	.025 /	.035
Dymerex Resin	lb.	.135 /	.1475
Elastex 36-R	lb.	.43 /	.4625
37-R	lb.	.70 /	.71
Emulphor EL-719	lb.	.52 /	.73
Endor	lb.	.67	
Ethox	lb.	.43 /	.455
Ethylene glycol, comml.	lb.	.135 /	.165
Wyandotte	lb.	.1325/	.1425
Flexol 3 GH	lb.	.44 /	.46
3 GO	lb.	.53 /	.55
4 GO	lb.	.325 /	.355
10-A	lb.	.425 /	.455
426	lb.	.27 /	.30
810, 810X, 10-10, 10-10X	lb.	.305 /	.335
TOF, A-26	lb.	.435 /	.465
Flexricin P-4	lb.	.3475/	.3625
P-6	lb.	.415 /	.43
P-8	lb.	.3475/	.3625
PG-16	lb.	.335 /	.35
Fortex	lb.	.125 /	.145
Fura-Tone NC 1008	lb.	.28	
1012	lb.	.46	
G. B. Asphaltic Flux	gal.	.097 /	.177
Naphthenic Neutrals	gal.	.125 /	.215
Process oil, light	lb.	.0275/	.0375
Medium	lb.	.0375/	.0475
Galex W-100	lb.	.155 /	.18
W-100 D	lb.	.1525/	.1775
Gilsowax B	lb.	.0975/	.11
Harchemex	lb.	.24 /	.345
Harflex 300	lb.	.58 /	.675
325	lb.	.4325/	.52
375	lb.	.7425/	.83
500	lb.	.315 /	.41
HB-20	lb.	.19 /	.22
-40	lb.	.15 /	.17
Heavy Resin Oil	lb.	.0225/	.0375
HSC-13	lb.	.25 /	.32
-39	lb.	.22 /	.29
Hycar 1312	lb.	.60	
Kapsol	lb.	.33 /	.355
Kenflex A, L	lb.	.26 /	.27
B	lb.	.23 /	.24
N	lb.	.18 /	.19
Kessoflex 103	lb.	.405	
105	lb.	.3325	
106	lb.	.38	
107	lb.	.525	
110	lb.	.24	
111	lb.	.28	
KP-23	lb.	.315 /	.325
-90	lb.	.40 /	.435
-140	lb.	.46 /	.485
-201	lb.	.58 /	.59
-220	lb.	.33 /	.365
-555	lb.	.59 /	.60
Kronisol	lb.	.33 /	.365
Kronitex AA, I, K-3, Mx	lb.	.325 /	.36
LX-685, -125, -135	lb.	.125 /	.135
Marvinol plasticizers	lb.	.28 /	.8825
Methox	lb.	.385 /	.41
Monoplex S-38	lb.	.215 /	.24
S-71	lb.	.45 /	.475
Morflex	lb.	.25 /	.65
Natac	lb.	.12 /	.13
Neoprene Peptizer P-12	lb.	1.05	
Nevillac	lb.	.31 /	.85
Neville R Resins	lb.	.145 /	.205
Nevinol	lb.	.24	
No. 1-D heavy oil	lb.	.065	
NP-10	lb.	.50 /	.53
ODA (octyldecyladipate)			
Good-rite GP-235	lb.	.40 /	.55
Kessoflex	lb.	.40 /	.435
RC	lb.	.40 /	.54
ODP (octyldecylphthalate)			
Good-rite GP-265	lb.	.29 /	.445
Hatco	lb.	.305 /	.335
Rubber Corp. of America	lb.	.255 /	.43
Ohopex Q-10	lb.	.28 /	.315
R-9	lb.	.3525/	.3775
Orthonitro benzophenol, comml.	lb.	.13 /	.15
Palmalene	lb.	.15	
Panaflex BN-1	lb.	.185 /	.225
Panarez Resins	lb.	.09 /	.14
Para Flux, regular	gal.	.10 /	.2125

MACHINERY & SUPPLIES FOR SALE (Cont'd)

TWO LATEX CIRCULATING DIPT TANKS COMPLETE WITH Motors, Agitators, Reduction Gears. Used, but in operating condition. Inspection Invited; Vicinity of New York. CAN BE PURCHASED TO ADVANTAGE. Address Box No. 2304, care of RUBBER WORLD.

FOR SALE: GUILLOTINE RAW-STOCK CUTTER, NEW. A high-production rugged machine reasonably priced. Available for tryout at our Plant. STANIS INDUSTRIES, Romeo, Michigan.

HYDRAULIC PRESSES, 2500-TON DOWNSTROKE 54" x 102". 325-ton upstroke 28" x 28". 300-ton upstroke 40" x 30". 300-ton upstroke 22" x 35". 250-ton French Oil upstroke 38" x 28". 150-ton Farrel 24" x 24". Hartig 3¼" Plastic Extruder Electrically Heated. Adamson 6" Rubber Extruder. Thropp 3" x 8", 2-roll Lab Mill. New & Used Lab. 6" x 13", 6" x 16" and 8" x 16" Mills and Calenders, & sizes up to 84". Baker-Perkins & Day Heavy-Duty Jack. Mixers up to 200 gals. Hydraulic Pumps & Accumulators. Ball & Jewell #2 Rotary Cutter & other sizes. Colton 5½ T, 4 T & 3DT Preform Machines motor driven. Other sizes in Single-Punch & Rotary Pre-Form Machines. Banbury Mixers, Crushers, Churns, Tubers, Vulcanizers, Bale Cutters, Gas Boilers, etc. SEND FOR SPECIAL BULLETIN. WE BUY YOUR SURPLUS MACHINERY. STEIN EQUIPMENT COMPANY, 107 8TH STREET, BROOKLYN 15, NEW YORK. STERLING 8-1944.

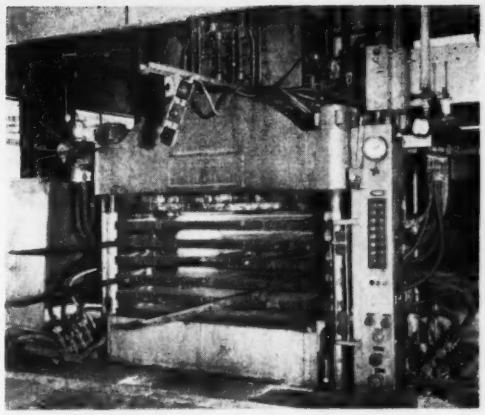
FOR SALE: 1—16" x 48"—3-ROLL VERTICAL CALENDER, M. D.; 1—32" x 32" hydraulic press, 16" ram; 1—6" x 12"—3-roll laboratory calender; 2—150-, 200-gallon Baker-Perkins double-arm mixers; also mixers, mills, cutters, etc. CHEMICAL & PROCESS MACHINERY CORP., 52 Ninth Street, Brooklyn 15, N. Y.

FOR SALE: 5 BAKER PERKINS 100-GAL. 15 JIM2, JACKETED, Sigma-Blade Mixers; 1—Robinson #1630 Plastic Cutter; 1—#1 Ball & Jewell Rotary Cutter; Powder Mixers; Tablet Presses; Screens. Your inquiries solicited. BRILL EQUIPMENT COMPANY, 2401 Third Ave., New York 51, N. Y.

THIS MONTH'S SPECIALS:
Heavy-duty rotary scrap cutter Ball & Jewell #2, 18" blades, 50 HP. motor drive. 18" x 40" three-roll vertical stack calender, herring-bone gears, 50-HP. motor and reducer. Rubber extruders, 3" Farrel, complete with motor drive, steamheated, late. Also, Royle Nos. 1, 2, 3, and 4 available with motor drives.

COMPLETE INSTALLATION STILL SET-UP IN PLANT. Model 3A Banbury Mixer, new in the 50s, with 150-HP motor drive running in conjunction with late-model top cap Adamson 22" x 60" rubber mill. Excellent condition and can be inspected under power.

JOHNSON MACHINERY COMPANY
683 Frelinghuysen Avenue, Newark 12, New Jersey
BIgelow 8-2500



For Sale—
2 Exceptional Molding Presses

Two modern Watson-Stillman 6-deck, 900-ton molding presses with self-contained oil pumps and steam trim.

One 76" side-to-side, 50" front to back
One 76" side-to-side, 70" front to back

Must be moved from the Detroit area. Bargain prices on quality machines.

STEWART BOLLING & COMPANY, INC.
3192 East 65th St., Cleveland 27, Ohio
Phone MIchigan 1-2850

FLEXO JOINTS

THE STANDARD FOR SAFETY

- Proved in years of efficient service, FLEXO JOINTS offer the flexibility of hose — the strength of pipe — the ideal steam connection for presses, tire molds, etc.

Four styles, for standard pipe sizes ¼" to 3".

- Write for information and prices.

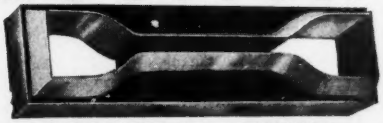
FLEXO SUPPLY CO., INC., 4651 Page Blvd., St. Louis 13, Mo. *In Canada:* S. A. ARMSTRONG, LTD. 1400 O'Connor Dr., Toronto 13, Ontario

BROCKTON TOOL COMPANY

Central Street — QUALITY MOULDS FOR ALL PURPOSES — South Easton, Mass.

THE FIRST STEP — A QUALITY MOULD

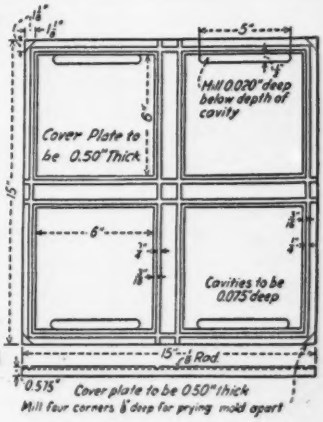
HOGGSON



"DUMBBELL" Test Strip Die D412(51T)

TOOLS, MOLDS, DIES
For Rubber Testing and Production

For making tensile test samples, we make many types of slab molds. One is detailed at the right. These are plain or chrome finished. We usually stock molds for making adhesion, abrasion, flexing, compression and rebound test samples, but supply special molds promptly. We also furnish hand-forged tensile dies for cutting regular or tear test samples.



SLAB→ MOLD D15-55

HOGGSON & PETTIS MFG. CO., 1415 Brewery St., New Haven 7, Conn.
Pac. Coast: H. M. Royal, Inc., Downey, Calif.

Para Flux No. 2016	gal.	$0.165 /	$0.24
2332	gal.	.11	
4205	lb.	.1075/	.2125
Paralube	lb.	.46 /	.48
Resins	lb.	.04 /	.045
Paradene Resins	lb.	.07 /	.08
Paraplex 5-B	lb.	.29 /	.3475
Al-111	lb.	.32 /	.3275
G-25	lb.	.76 /	.77
-40	lb.	.4825/	.51
-50	lb.	.39 /	.4175
-53	lb.	.4325/	.46
-60	lb.	.325 /	.35
-62	lb.	.345 /	.37
RG-7	lb.	.33 /	.335
-8	lb.	.505 /	.5125
-10	lb.	.52 /	.5275
Peptizer 620	lb.	.37	
Peptizer 640	lb.	.42	
Pepton 22	lb.	.83 /	.86
65	lb.	1.23 /	1.26
65-B	lb.	.83 /	.86
Philrich 5	gal.	.11	
Picco Resins	lb.	.1275/	.22
480 Oilproof Series	lb.	.18 /	.23
Aromatic Plasticizers	lb.	.05 /	.065
Liquid Resin D-165 (V)	lb.	.06 /	.075
(Z-3)	lb.	.07 /	.085
(Z-6)	lb.	.08 /	.095
S. O. S.	gal.	.29 /	.34
Piccocizers	lb.	.04	.055
Piccolastic Resins	lb.	.16 /	.25
Piccolyte Resins	lb.	.205 /	.245
Piccopale Resins	lb.	.12 /	.135
Piccovars	lb.	.165 /	.20
Piccovol	lb.	.025 /	.038
Pictar	gal.	.25 /	.30
Pigmentar	lb.	.046 /	.0634
Pigmentaroil	lb.	.046 /	.0634
Pitch, Burgundy, Sunny South	lb.	.1030/	.1085
Plasticizers			
42	lb.	.34 /	.40
84	lb.	.25/	.29
B	lb.	.35 /	.45
DP-520	lb.	.435 /	.455
MP	lb.	.035 /	.0755
MT-511	lb.	.6925/	.7425
ODN	lb.	.35 /	.475
SC	lb.	.40 /	.515
Plastoflex #3	lb.	.52 /	.57
#520	lb.	.36 /	.435
DBE	lb.	.50 /	.55
MGB	lb.	.29 /	.37
SP-2	lb.	.43 /	.48
VS	lb.	.3575/	.3975
Plastogen	lb.	.0875/	.09
Plastone	lb.	.25 /	.32
Polycin 470	lb.	.325 /	.34
Polyclzers	lb.	.25 /	.415
162	lb.	.25 /	.405
Polymel-C	lb.	.1775/	.1875
D	lb.	.225 /	.235
D-TAC	lb.	.1975/	.215
DX, C-130	lb.	.1375/	.1475
Poly-Sperse AP-2	lb.	.23 /	.295
AP-300	lb.	.26 /	.325
LC-20	lb.	.26 /	.325
R-100	lb.	.17 /	.325
PT Pine Tars	lb.	.038 /	.0554
101 Pine Tar Oil	lb.	.038 /	.0554
Reogen	lb.	.1425/	.145
Resin C pitch	lb.	.0225/	.031
R6-3	lb.	.38 /	.40
Resinex 10, 25, 50, 110	lb.	.04 /	.045
70	lb.	.0325/	.0375
85, 100	lb.	.035 /	.04
115	lb.	.0375/	.0425
L-2, L-3, L-4, L-5	lb.	.0225/	.03
Rosin Oil, Sunny South	gal.	.58 /	.76
RPA No. 2	lb.	.85	
3	lb.	.51	
Conc.	lb.	.85	
5	lb.	.68	
6	lb.	1.66	
RSN Flux	gal.	.10 /	.91
Rubber Oil B-5	lb.	.0225/	.0355
Rubberol	lb.	.18 /	.2725
Santicizer 1-H	lb.	.50 /	.52
8	lb.	.44 /	.46
9	lb.	.42 /	.44
140	lb.	.325 /	.36
141	lb.	.34 /	.375
160	lb.	.25 /	.29
409	lb.	.39	
602	lb.	.285	
B-16	lb.	.4475/	.4675
E-15	lb.	.51 /	.54
Santocizer	lb.	.4275/	.4575
Sebacic acid, purified, comml.	lb.	.59 /	.65
Binney & Smith	lb.	.64 /	.76
C. P., Binney & Smith	lb.	.72 /	.84
Harchem	lb.	.69 /	.89
Sherolatum Petroleum	lb.	.05 /	.10
Softener #20	gal.	.10 /	.20
Special Rubber Resin 100	lb.	.1675/	.2175
Staflex AX	lb.	.43	
DBES	lb.	.61 /	.635
Syn-Tac	gal.	.33 /	.35
Synthol	lb.	.17 /	.2625
Thiokol TP-90B	lb.	.59	
-95	lb.	.65	
Triacetin	lb.	.365 /	.405
Tributyl phosphate	lb.	.50 /	.535
Tributyrin	lb.	.69	
Tricresyl phosphate, comml.	lb.	.33 /	.36
Monsanto	lb.	.325 /	.36
Naugatuck	lb.	.33 /	.36
PX-917	lb.	.33 /	.36
Triphenyl phosphate, comml.	lb.	$0.39 /	$0.40
Monsanto	lb.	.415 /	.435
Turgum S	lb.	.1075/	.1175
SB	lb.	.07/	.08
Turpol NC 1200	lb.	.61 /	.70
Tysonite	lb.	.3025/	.305
United	gal.	.69 /	1.20
X-1 Resinous Oil	lb.	.0225/	.0325

Reclaiming Oils

Acintol C, P	lb.	.02 /	.03
Bardol, 639	lb.	.0275/	.0375
B	lb.	.055 /	.065
BRH 2	lb.	.0213/	.0351
BRT 3	lb.	.02 /	.031
4	lb.	.02 /	.031
7	lb.	.035 /	.036
BRV	lb.	.0625/	.065
Burco-RA	lb.	.053 /	.0805
BWH-1	lb.	.16 /	.18
Dipolymer Oil	gal.	.33 /	.43
Dispersing Oil No. 10	lb.	.06 /	.0625
G. B. Oils	gal.	.115 /	.275
Heavy Resin Oil	lb.	.0225/	.0375
LX-572	gal.	.27 /	.32
-759	gal.	.1375	
-777, -809, -859	gal.	.23 /	.33
-869	gal.	.33 /	.43
-871	gal.	.34 /	.44
No. 3186	gal.	.28 /	.295
Picco 6535	gal.	.25 /	.30
C-33	gal.	.215 /	.315
-42	gal.	.23 /	.33
D-4	gal.	.27 /	.37
E-5	gal.	.25 /	.35
Q-Oil	gal.	.286 /	.36
PT 101 Pine Tar Oil	lb.	.038 /	.0554
Reclaiming Oil #3186	gal.	.28 /	.385
-G	gal.	.25 /	.365
4039-M	gal.	.3275/	.3975
-Y	gal.	.30 /	.37
RR-10	lb.	.37	
S. R. O.	lb.	.015 /	.0225
X-1 Resinous Oil	lb.	.0225/	.0325

Reinforcers, Other Than Carbon Black

Angelo Shellacs	lb.	.485 /	.7325
Borden, Chem. Div.			
Arcco 978-42B	lb.	.18 /	.19
1073-18B	lb.	.135 /	.145
1294-36B	lb.	.115 /	.125
1301-12B	lb.	.15 /	.16
BRC-20	lb.	.0235/	.0245
22	lb.	.026 /	.0285
30	lb.	.0165/	.025
521	lb.	.023	
Bunarex Resins	lb.	.065 /	.1225
Cab-o-sil	lb.	.67 /	.85
Calcene CO	ton	105.00	
NC	ton	80.00 /	100.00
TM	ton	82.50 /	102.50
Calco S. A.	lb.	.85 /	.88
Car-Bel-Rez C	lb.	.126 /	.1451
Clays			
Aiken	ton	14.00	
Aluminum Flake	ton	22.25 /	60.00
Buca	ton	45.00	
Burgess Iceberg	ton	50.00 /	80.00
Icecap K	ton	65.00 /	90.00
Pigment #20	ton	35.00 /	60.00
#30	ton	37.00 /	60.00
Catalpo	ton	35.00	
Crown	ton	14.00 /	33.00
Dixie	ton	14.50	
Franklin	ton	13.50 /	35.25
L. G. B.	ton	17.50	
McNamee	ton	14.50	
Par	ton	15.00	
Paragon	ton	14.50 /	33.00
Pigment No. 33	ton	37.00	
Polyfil C	ton	25.00	
Recco	ton	14.00	
Suprex	ton	14.50 /	33.50
Swanee	ton	12.50	
Whitetex	ton	50.00	
Windsor	ton	14.00 /	30.00
Witco No. 1	ton	14.00 /	30.00
No. 2	ton	13.50 /	30.00
Clearcarb	lb.	.1175/	.1255
Cumar Resins	lb.	.065 /	.17
Darex Resins	lb.	.42 /	.49
DC Silica	lb.	1.15 /	1.40
Diatomaceous silica	ton	32.00 /	48.00
Good-rite 2007		.36 /	.38
2057		.30 /	.31
K Series Polymers	lb.	.15 /	.37
233	lb.	.08 /	.095
X303	lb.	.40 /	.45
Hi-Sil 233	lb.	.08 /	.095
X303	lb.	.40 /	.45
Hycar 2001	lb.	.55	
2007	lb.	.39	
Indulins	lb.	.06 /	.08
Kralac A-EP	lb.	.43 /	.54
Laminar	ton	30.00	
Magnesium carbonate, Marinco CL	lb.	.11 /	.14
Marbon Resins	lb.	.36 /	.43
Multifex MM	ton	117.50 /	137.50
Super	ton	167.50 /	187.50
Neville Resins			
465	lb.	.075 /	.08
LX-509	lb.	.33 /	.35
Nebony	lb.	.045 /	.05
Paradene	lb.	.07 /	.08
R	lb.	.145 /	.205
Para Resins 2457	lb.	.04 /	.045
Parapol S-Polymers	lb.	.44	
Picco Resins	lb.	$0.1275/	$0.22
Piccolyte Resins	lb.	.205 /	.275
Piccoumaron Resins	lb.	.07 /	.19
Piccovars	lb.	.145 /	.20
Pliolite NR types	lb.	.98 /	1.33
S-3	lb.	.42 /	.49
S-6	lb.	.36 /	.43
-6B	lb.	.36 /	.43
E	lb.	.36 /	.43
Plio-Tuf G85C	lb.	.52 /	.59
Purecal M	ton	56.75 /	71.75
SC, T	ton	110.00 /	125.00
U	ton	120.00 /	135.00
R-B-H 510	lb.	.15 /	.22
Resinex	lb.	.0375/	.0525
Rubber Resin LM-4	lb.	.28 /	.35
Silene EF	ton	110.00 /	130.00
L	lb.	.0575/	.0675
Silvacons	ton	55.00 /	85.00
Transphalt	lb.	.0375/	.0525
Witcarb P	ton	117.50 /	153.50
R	ton	127.50 /	163.50
Regular	ton	60.00 /	96.00
Zeolex 23	lb.	.055 /	.065
Zinc oxide, commercial†	lb.	.135 /	.1775

Retarders

Benzoic acid TBAO-2	lb.	.44	
E-S-E-N	lb.	.37 /	.39
Good-rite Vultrol	lb.	.62 /	.66
R-17 Resin	lb.	.1075/	.36
Retarder ASA	lb.	.57	
J	lb.	.68 /	.73
PD	lb.	.39 /	.41
W	lb.	.46	
Retardex	lb.	.47 /	.50
Thionex	lb.	1.14	
Wiltrol P	lb.	.39 /	.41

Solvents

Bondogen	lb.	.555 /	.605
Butyrolactone	lb.	.60 /	.65
Cosol #1	gal.	.37 /	.43
#2	gal.	.42 /	.48
Dichloro Pentanes	lb.	.04 /	.07
Dipentene DD, Sunny South	gal.	.42 /	.63
Ethylene dichloride, comml.	lb.	.09 /	.122
Hi-Flash 2-50-W	gal.	.41	
Pale yellow	gal.	.39	
LX-572	gal.	.27 /	.32
-748	gal.	.16 /	.23
Methyl-2-pyrrolidone	lb.	.75 /	.80
Neville Nos. 100, 104	gal.	.52 /	.60
106	gal.	.38 /	.46
Nevsolv H. 200	gal.	.19 /	.29
HF, T. 30	gal.	.24 /	.34
Penetrell	gal.	.42 /	.63
Picco Hi-Solv Solvents	gal.	.16 /	.48
Pine Oil DD, Sunny South	lb.	.15	
Skellysolve-B	gal.	.17	
-H	gal.	.148	
-R, -V	gal.	.139	
-C	gal.	.162	
Stauffer Carbon Disulfide	lb.	.0525/	.085
Tetrachloride	lb.	.0825/	.475

Tackifiers

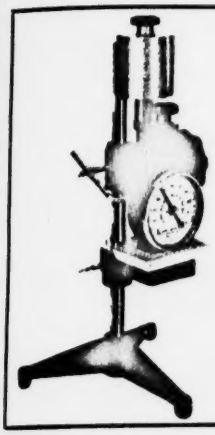
Acintol R	lb.	.065 /	.07
Bardol, 639	lb.	.0275/	.0375
Borden, Arcco			
A25, A26, 716-30	lb.	.18 /	.19
555-40R	lb.	.185 /	.205
620-32B	lb.	.20 /	.21
716-35	lb.	.17 /	.18
1041-21	lb.	.165 /	.175
BRH 2	lb.	.0213/	.0351
Bunarex Resins	lb.	.065 /	.1225
Chlorowax 70	lb.	.18 /	.24
Contogums	lb.	.0875/	.11
Cumar Resins	lb.	.065 /	.17
Galex W-100	lb.	.155 /	.17
W-100D	lb.	.1525/	.1625
Indopol H-35	gal.	.65 /	.84
H-50	gal.	.70 /	.89
-100	gal.	.85 /	1.08
-300	gal.	1.00 /	1.24
-1500	gal.	1.48	
L-10	gal.	.40 /	.59
-50	gal.	.45 /	.64
-100	gal.	.55 /	.74
Kenflex resins	lb.	.18 /	.27
Koresin	lb.	.90 /	1.10
Natac	lb.	.12 /	.13
Nevindene	lb.	.15 /	.18
Picco Resins	lb.	.1275/	.22
Piccolastic Resins	lb.	.1855/	.34
Piccolyte Resins	lb.	.185 /	.25
Piccopale Resins	lb.	.089 /	.13
Piccoumaron Resins	lb.	.07 /	.185
R-B-H 510	lb.	.15 /	.22
Roelflex 1118A	lb.	.39	
Synthetic 100	lb.	.41	
Synthol	lb.	.17 /	.2625
United	gal.	.69 /	1.20

Vulcanizing Agents

Dibenzo G-M-F	lb.	2.60	
G-M-F #113, #117	lb.	.90	
Di-Cup	lb.	1.10	
Dodecenyl succinic anhydride	lb.	.75 /	.76
HMDA-Carbamate	lb.	4.50 /	4.90
Ko-Blend I, S	lb.	.39	
Litharge (*See Accelerator-Activators, Inorganic*)			

MACHINERY & SUPPLIES FOR SALE (Cont'd)

FOR SALE: BAKER PERKINS 100-GAL. WORKING, HEAVY-duty mixer, jacketed on 4 sides, double sigma arms cored, silent chain drive, starter for forward and reverse motion, grid cover with safety device. EQUIPMENT CLEARING HOUSE, INC., 111 33rd Street, Brooklyn, N. Y. SOuth 8-4451.



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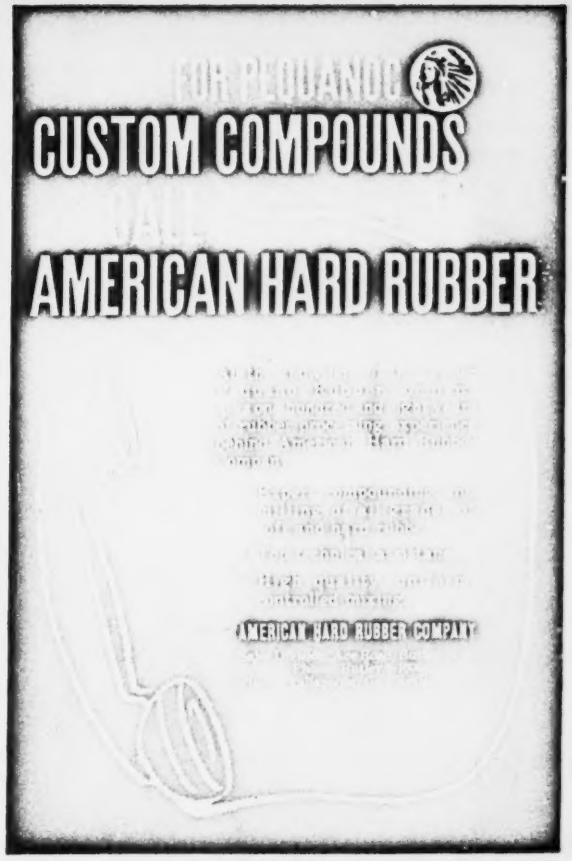

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Note

Suppliers are requested to submit product additions or deletions and price changes promptly as they occur in order that we may make the listing of maximum service to our readers. Comments on the present listing and classifications are invited with a view toward facilitating location of specific items.

Correspondence should be directed to: Market Editor, RUBBER WORLD, 630 Third Avenue, New York 17, New York.

Magnesium oxide	*lb.*	$0.2525/	$0.38
Maglite D, K, Y	*lb.*	.2525/	.305
L	*lb.*	.2975/	.3225
M	*lb.*	.27 /	.32
Marmag	*lb.*	.2475/	.295
PSD 85	*lb.*	.37 /	.50
Red Lead (*See Accelerator-Activators, Inorganic*)			
Sulfasan R	*lb.*	1.55 /	1.57
Sulfur flour, comml.	100 *lbs.*	2.55 /	3.30
1018	*lb.*	.12 /	.1575
Aero	100 *lbs.*	2.40 /	7.75
Crystex	*lb.*	.195 /	.23
Insoluble 60	*lb.*	.125 /	.13
Rubbermakers	100 *lbs.*	2.65 /	4.55
Stauffer	*lb.*	.0265/	.054
Telloy	*lb.*	2.75	
VA-7	*lb.*	.50 /	.60
Vandex	*lb.*	7.50	
Vultac No. 2	*lb.*	.47 /	.74
3	*lb.*	.51 /	.78
White lead silicate (*See Accelerator-Activators, Inorganic*)			

Rayon and Nylon

(Continued from page 922)

tenacity rayon yarn, 16,200,000 pounds; regular-tenacity yarn, 55,600,000 pounds.

There were no reported price changes during the period under review.

RAYON PRICES

Tire Fabrics

1100/490/2	$0.625/$0.78
1650/908/2	.685/ .685
2200/980/2	.625/ .655

Tire Yarns

High-Tenacity	
1100/ 490, 980	.66/ .66
1100/ 490	.66/ .66
1150/ 490, 980	.59/ .63
1165/ 480	.59/ .65
1230/ 490	.59/ .63
1650/ 720	.55/ .58
1650/ 980	.55/ .58
1875/ 980	.55/ .58
2200/ 960	.54/ .57
2200/ 980	.54/ .57
2200/1466	.64
4400/2934	.60
Super-High Tenacity	
1650/ 720	.60
1900/ 720	.58

NYLON PRICES

Tire Yarns

840/ 140	$1.10/$1.20
1680/ 280	1.20

CALENDAR of COMING EVENTS

March 16-18
Society of Automotive Engineers. National Passenger Car, Body, and Materials Meeting. Sheraton-Cadillac, Detroit, Mich.

March 19
Quebec Rubber & Plastics Group.

March 20
New York Rubber Group. Henry Hudson Hotel, New York, N. Y.
Boston Rubber Group. Hotel Somerset, Boston, Mass.

March 30-April 1
American Physical Society. Cambridge, Mass.

March 31-April 2
Division of High-Polymer Physics, APS. Cambridge, Mass.

April 2
Rhode Island Rubber Club. Spring Meeting. Pawtucket Country Club, Pawtucket, R.I.

April 3
Akron Rubber Group. Sheraton Hotel, Akron, O.

April 5-8
National Association of Waste Material Dealers, Inc. Forty-Sixth Annual Convention. Edgewater Beach Hotel, Chicago, Ill.

April 6
Washington Rubber Group.

April 6-7
Division of Polymer Chemistry, ACS. Boston, Mass.

April 7
The Los Angeles Rubber Group, Inc. Biltmore Hotel, Los Angeles, Calif.

April 16
Fort Wayne Rubber & Plastics Group. Van Orman Hotel, Fort Wayne, Ind.

April 17
Detroit Rubber & Plastics Group, Inc. Detroit Leland Hotel, Detroit, Mich.

April 24
Chicago Rubber Group. Furniture Club, Chicago, Ill.

May 1
Buffalo Rubber Group and Ontario Rubber Group, CIC. Joint International Meeting. Hotel Sheraton-Brock, Niagara Falls, Ont., Canada.
Division of Rubber Chemistry, Chemical Institute of Canada. Annual Convention. Hotel Sheraton-Brock, Niagara Falls, Ont., Canada.
Philadelphia Rubber Group. Poor Richard Club Philadelphia, Pa.

May 4
Washington Rubber Group.

May 12-15
Division of Rubber Chemistry, American Chemical Society. Biltmore Hotel, Los Angeles, Calif.

May 22
Connecticut Rubber Group.

May 25-27
Chemical Institute of Canada. Forty-Second Annual Convention. Halifax, Nova Scotia, Canada.

June 4
New York Rubber Group. Outing. Doerr's Grove, Milburn, N. J.

June 5
Fort Wayne Rubber & Plastics Group. Outing.
Quebec Rubber & Plastics Group. Outing.

June 9
Buffalo Rubber Group. Golf Outing. Lancaster Country Club, Buffalo, N.Y.

June 12-14
Southern Rubber Group. Desert Ranch, St. Petersburg, Fla.
Rhode Island Rubber Club. Twenty-Fifth Anniversary Outing. The Belmont, West Harwich-by-the-Sea, Mass.

June 15-19
American Society of Engineering Education. Pittsburgh, Pa.

June 19
Akron Rubber Group. Outing. Firestone Country Club.
Boston Rubber Group. Outing. Andover Country Club, Andover, Mass.

June 22-26
American Society for Testing Materials. Annual Meeting. Atlantic City, N. J.

June 26
Detroit Rubber & Plastics Group, Inc. Outing. Western Golf & Country Club.

August 4
New York Rubber Group. Golf Tournament. Forsgate Country Club, Jamesburg, N. J.

September 12
Connecticut Rubber Group. Outing.

Malaya

(Continued from page 918)

despite political disturbances, Sumatra sent 178,481 tons, or 7½% more than in 1957. Shipments from Indonesian Borneo to Singapore rose 6½% to 102,628.

An interesting development is the 54½% spurt in total exports to the Federation; Sumatra sent 37,269 tons, 60% more than she exported in the preceding year.

Decreased shipments by Sarawak and North Borneo to Singapore last year are interpreted as indications of a trend in these rubber centers to deal directly with customers, rather than through Singapore.

Index to Advertisers

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A

American Cyanamid Co.:
Pigments Division 827
Rubber Chemicals Dept. 921
American Hard Rubber Co. 933

B

Black Rock Mfg. Co. 927
Bolling, Stewart, & Co., Inc. 806, 931
Brockton Tool Co. 931

C

Cabot, Godfrey L., Inc. .... Back Cover
Carter Bell Mfg. Co., The 818
Cary Chemicals, Inc. 837
Claremont Flock Corp. 802
CLASSIFIED
ADVERTISEMENTS 929, 931, 933
Cleveland Liner & Mfg. Co., The .. 850
Columbia-Southern Chemical
Corp. ..... Insert 822, 823
Columbian Carbon Co. .. Insert 883, 884
CONSULTANTS & ENGINEERS 933
Continental Carbon Co. .... Insert 911
Copolymer Rubber & Chemical
Corp. ..... Insert 819

D

Darlington Chemicals, Inc. 804
Dow Corning Corp. 838, 839
DPR Incorporated, A Subsidiary of
H. V. Hardman Co. 804
du Pont de Nemours, E. I., & Co.
Second Cover
Durez Plastics Division,
Hooker Chemical Corp. 824

E

Eagle-Picher Co., The 802
English Mica Co., The 933
Enjay Co., The 919
Erie Engine & Manufacturing Co. ... 814

F

Farrel-Birmingham Co., Inc. 829
Firestone Synthetic Rubber & Latex
Co., Division of Firestone Tire &
Rubber Co. .....Insert 833-836
Flexo Supply Co., Inc. 931
French Oil Mill Machinery Co., The . 794

G

General Latex & Chemical Corp. .. 912
General Tire & Rubber Co., The
(Chemical Division) 816, 817
Goodrich, B. F., Chemical Co. 789
Goodrich-Gulf Chemicals, Inc. . 812, 813
Goodyear Tire & Rubber Co., Inc.,
The (Chemical Division) Insert 797-800

H

Hale & Kullgren, Inc. 933
Hall, C. P., Co., The 843
Harchem Division, Wallace &
Tiernan, Inc. 807
Harwick Standard Chemical Co. ... 805
Hoggson & Pettis Mfg. Co., The 931
Holmes, Stanley H., Co. 828
Hooker Chemical Corp.,
Durez Plastics Division 824
Houdry Process Corp. 821
Huber, J. M., Corp. 854

I

Independent Die & Supply Co. 814

J

Johnson Corp., The 806

K

K. B. C. Industries, Inc. 933
Kessler Chemical Co., Inc. 796

L

Litzler, C. A., Co., Inc. 845

M

Marbon Chemical Division of
Borg-Warner Corp. 801
Miller-Stephenson Chemical Co., Inc. 806
Monsanto Chemical Co., Rubber
Chemicals Dept. 811
Muehlstein, H., & Co., Inc. 795

N

National Rosin Oil Products, Inc. ... 933
National Rubber Machinery Co. 841
Naugatuck Chemical Division of
U. S. Rubber Co. 792, 793
Neville Chemical Co. 815

O

Ozone Research and Equipment
Corp. 804

P

Phillips Chemical Co. .. Insert 893, 894

R

Rare Metal Products Co. 927
Richardson, Sid, Carbon Co. 936
Richardson Scale Co. 796
Roebling's, John A., Sons Corp. Insert 849
Royle, John, & Sons 802
Rubber Corp. of America 927

S

Schulman, A., Inc. ..... Third Cover
Scott Testers, Inc. 826
Scovill Manufacturing Co. 825
Shaw, Francis, & Co., Ltd. 820
Shell Chemical Corp.,
Synthetic Rubber Division .. 852, 853
Shore Instrument & Manufacturing
Co., Inc., The 933
South Texas Tire Test Fleet, Inc. 814
Southeastern Clay Co. 808
Spadone Machine Co., Inc. 818
Stamford Rubber Supply Co., The .. 808
Sun Oil Co. 915

T

Taylor Instrument Cos. 848
Testing Machines, Inc. 794
Texas-U. S. Chemical Co. Insert 846, 847
Titanium Pigment Corp. 803

U

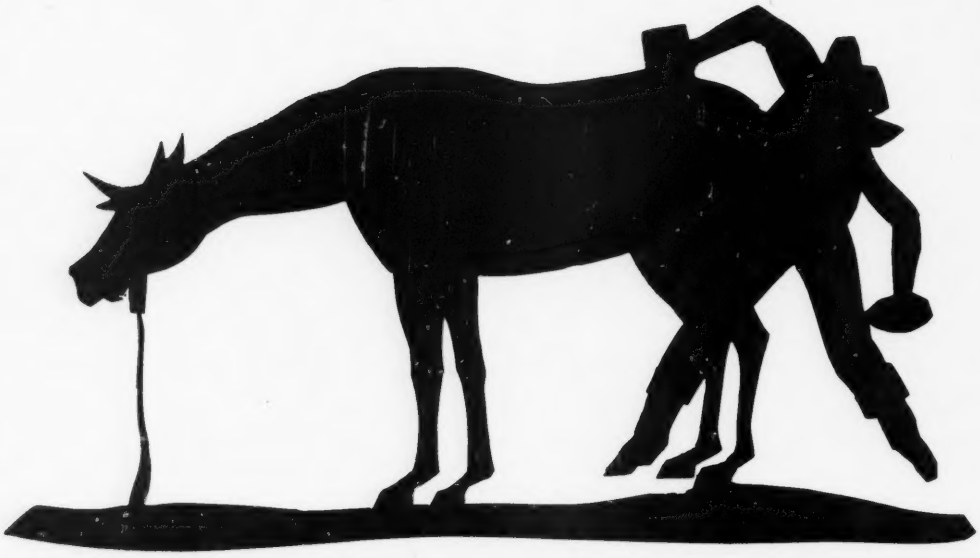
United Carbon Co., Inc. . Insert 809, 810
United Rubber Machinery Exchange . 933
U. S. Rubber Reclaiming Co., Inc. .. 832
Universal Oil Products Co. 830, 831

V

Vanderbilt, R. T., Co., Inc. 856

W

Wellington Sears Co. 923
Williams, George A., & Son 808
Witco Chemical Co., Inc. .... Insert 911



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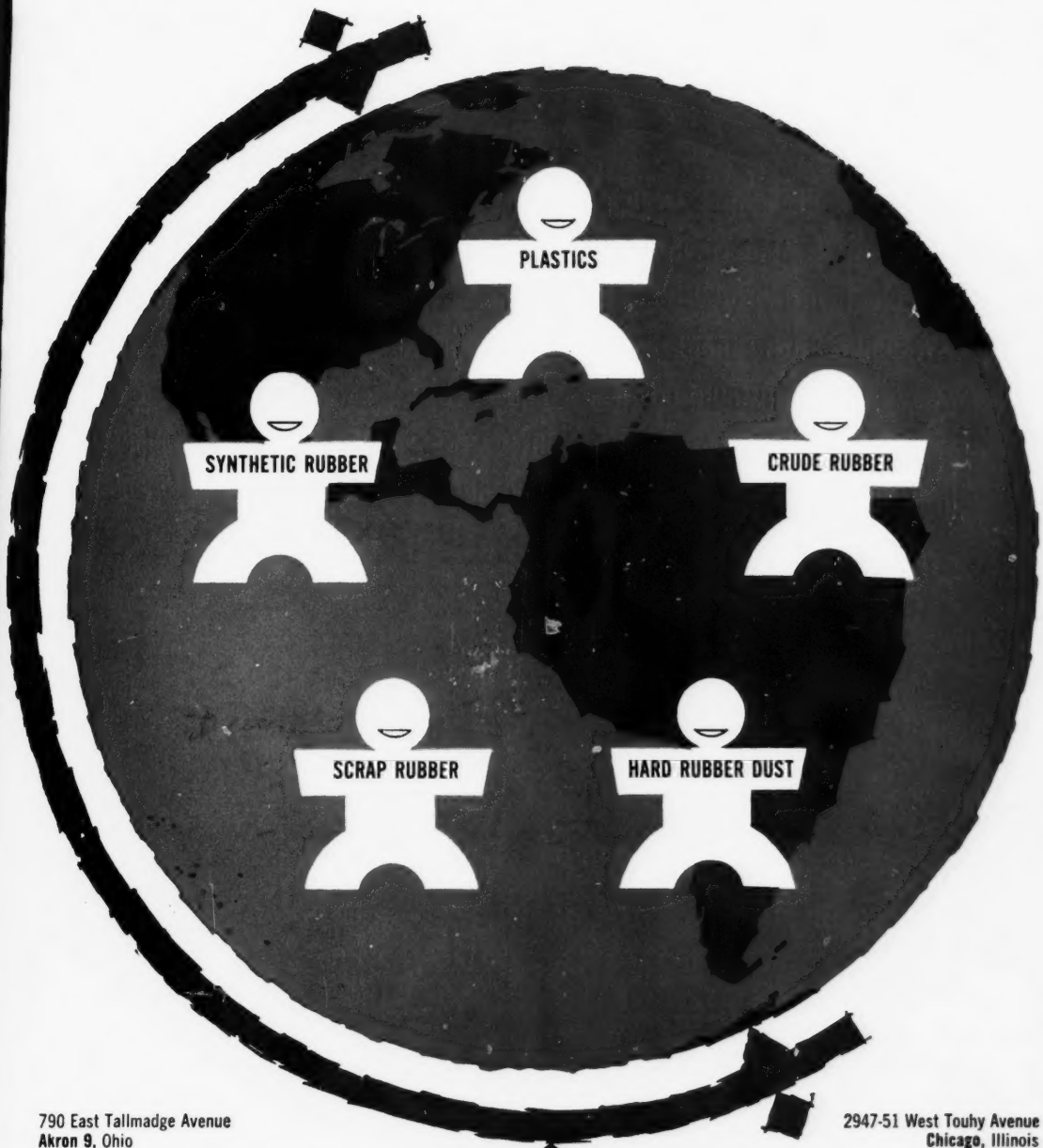

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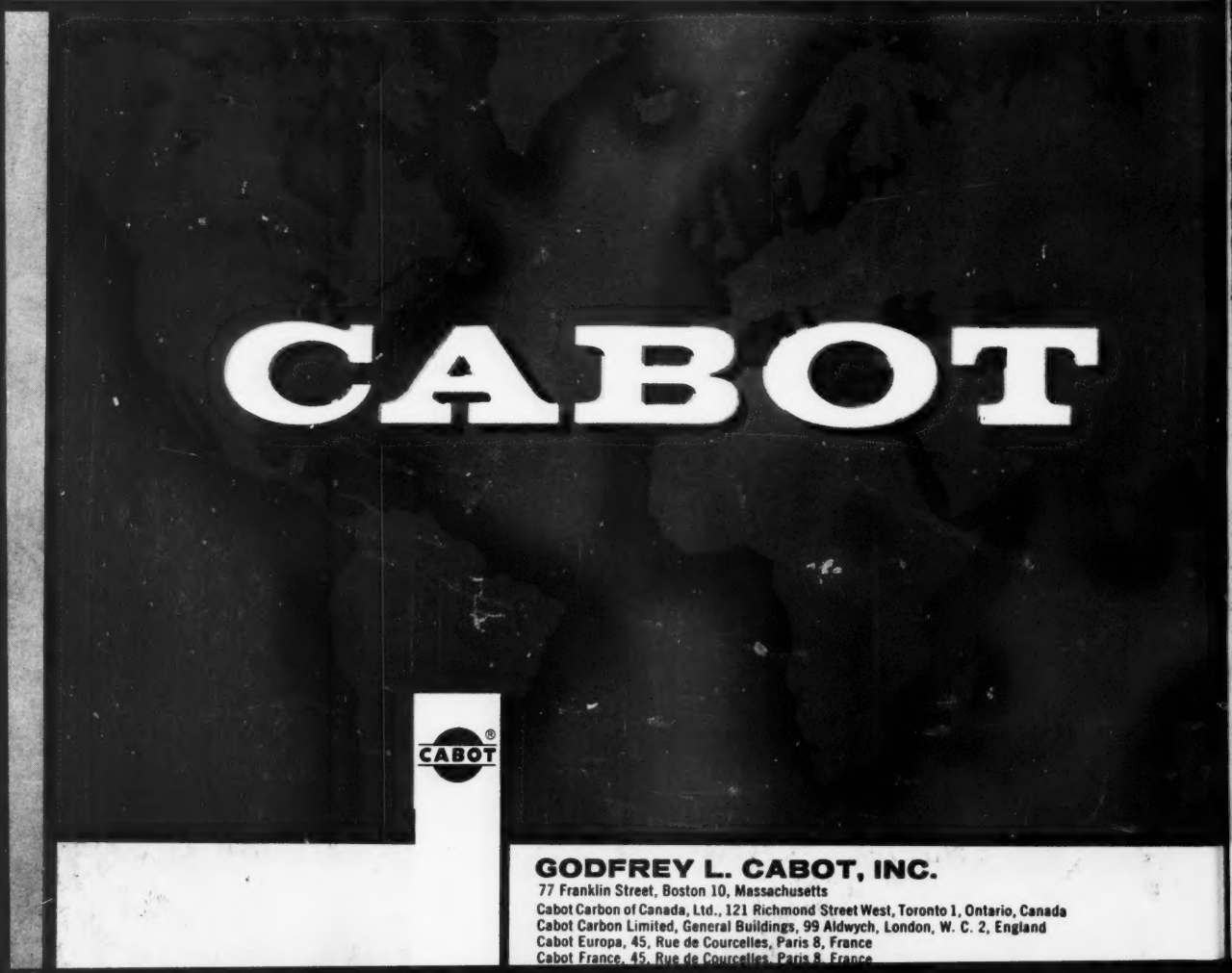

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